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PERFECTING THE MOTOR DRIVE.

The electric motor drive continues to be improved year by year in two important directions; (1) in the design of the motor, and (2) in the more skillful application of this most attractive method of operating machinery. The critical study of individual motor-driven installations deserves more attention on the part of central-station engineers, and the rewards of such work are far reaching. Setting aside the question of motor design, which is above all a problem for the manufacturing specialist and seldom one for the central station except in the careful specification of work to be accomplished, it is worth while to consider the direction of improvement in commercial installations as noted in recent inspections.

One of the most desirable lines of attack is that of shortening the distance between the motor and the main shaft of the driven machine, where individual equipment is provided. There is a tendency in many cases to employ too long a belt, often obstructing passageways or, at the least, running above the machine and throwing more or less dirt upon the product or material in process. On account of the slow speed of many special machines, substantial reductions in pulley rotations are necessary between the motor pinion and the machine shaft, but these can usually be effected either through gearing or by the use of silent chains, with a very decided saving in space.

Brackets for motor support can be applied to the most irregular machine frames, and by cutting out superfluous lengths of belting the installation can be much improved, both in appearance and in energy consumption. Where gearing is substituted for long belting drives, care should be taken to secure well fitting meshes throughout the entire width of the gear. The uneven wear and strain brought upon a gear which only half meshes, leaving a great percentage of the tooth length inactive, are due of course to mechanical maladjustment, but it is in the mechanical application of electric motors that most of the present opportunity for improvement lies.

The demand for compact drives is putting more and more motors inside what might be called the "working cube" of the driven machine, where it occupies absolutely no external space of value to the factory owner. In some of the latest work of this kind, even the motor starting switch and the leading-in wiring are carried on the inside of the machine frame, so that it is unnecessary for the operator to

lose even a single second in starting or stopping the source of power. Compactness is also being served by casting the motor bearings into a protecting shell which can be used as a covering for the commutator or motor pinion. Where no external starting apparatus is required, the use of an inside-hung motor and an adjacent controlling switch reduce the question of power supply to about the simplest possible terms. A comparison of the cubic contents of a variety of individually driven machines and their respective motors would prove exceedingly interesting and might be utilized as excellent advertising material. The public has come to realize that high power can be compressed, so to speak, into a pretty small space by the use of electric motors, but the remarkably low percentage relation that space bears to the requirements of productive machinery is little known. Even the trained engineer often has to make a conscious effort to locate the motor in some of the latest individually operated machines, and the problem of taking photographs of such unobtrusive but powerful apparatus is sometimes one of considerable difficulty for this reason.

Only passing mention need be made of the desirability of testing the fitness of individual motors and even those used in group driving, for the most economical service. Progressive central stations have found that a willingness to provide the right size of motor is a drawing card in securing power business, and there is no question now that a readiness to substitute a different motor size or speed in cases where service test proves it desirable is one of the broadest and wisest policies. Close approximations can be made as to the best motor for a given service in numerous cases, but certain readjustments are often desirable, and if the central-station company stands behind these and co-operates with the power user to secure the most efficient results, it will be the gainer in the long run. Even a small stock of motors can be turned over in this way to the mutual benefit of both parties. If a 15-horsepower motor has to be substituted for a 10-horsepower machine, the user ought reasonably to meet the cost of the installation of the larger size originally. If the central staton does not carry motors, probably the best plan is to endeavor to arrange with the supply dealer to take back the oversized or undersized equipment; if that cannot be done, the central station might do far worse than to retain it for future sale.

With the growing use of alternating current, the question of improving local power-factors and load-factors is one of sufficient importance to warrant a long look ahead and to justify the most careful co-operative work in fitting motor sizes to their respective duties. Everything that can be done to make the installation of energy-consuming devices easier will in the long run redound to the profit of the central station and of the electrical manufacturer as well.

METAL-PROTECTED WIRING.

There seems to have been greater progress during the last two years in the adoption of conduit construction and the use of metal-armored cable where knob-and-tube wiring had previously been the rule than in any other period of equal duration in the development of the electrical industry. Following the lead of some of the large cities where metallic raceways or metal-armored conductors are required for all concealed circuits, rules have been adopted in perhaps most of the smaller cities, and in not a few of the small towns, also, making this sort of construction mandatory within certain localities and generally so in buildings of certain specified types. Even where no such rules exist, the combined efforts of fire underwriters, local inspection bureaus and the more progressive of the local electrical contractors have often resulted in at least a partial education of the owners of buildings to the superiority of this class of wiring. When the property owner has been convinced of its advantages it is easy enough, as a rule, to get him to adopt it.

The wonder is that the employment of metal-protected electric wiring has not become even more general. Of course, the first cost of such wiring may be greater than that of some of the older kinds of work; but that the installation may easily prove cheaper in the long run is a fact already recognized among competent electrical people. Moreover, where the initial cost of metal construction is found to be excessive, oftener than not it is due, in a large measure, to a lack of skill on the part of the wiremen who have been entrusted with the installation of the work; perhaps there has not been a proper selection of fittings, material has been wasted, and hours spent in bungling over jobs that a man with experience in such construction would need only a few minutes to do. There are proper ways of installing conduit and armored-cable circuits and the man who has not learned these is liable to find it very difficult to do a job that will pass even the most lenient inspection. It is not a sort of work that can be so easily skimped as can such construction as knob-and-tube wiring. Perhaps this accounts in a way for the continued popularity of knob-and-tube work in some quarters.

In the foregoing it is not meant to insist that a mechanic of average ability need have any difficulty in learning to put in metal-protected wiring. In fact, it would seem to be easier to learn to install flexible steel-armored cable work in old buildings, and in some kinds of new ones, too, than to learn to do a really high-class knob-and-tube job. There are places where the local contractors say they can install conduit or armored-cable work for less money per outlet than it costs them to do good knob-and-tube work, the reason being that so little of the latter kind of work is done that their men are extremely awkward at it.

In a town which is now recalled, where knob-and-

tube wiring is not approved by the local inspection department, the practice of wiring new buildings of the small-residence class with steel-armored flexible cable is quite common. As one watches a job of this sort, one is impressed especially with the simplicity of it and the speed with which the work can be done. And when such an installation is finished it is certainly much superior, from the standpoint of safety and permanency, to the very best of knob-and-tube construction.

ENCOURAGING OFF-PEAK ELECTRIC HEATING AND COOKING.

Comment has been made in these columns from time to time on various schemes for popularizing electric heating and cooking, particularly through the establishment of electric restaurants, which have become quite successful in England. Wide-awake central-station managers are quick to see the value of any increase of load, especially one that comes in units of 500 watts or more, but if this increase is most pronounced at the time of day when there is already a burdensome peak it is no wonder that their enthusiasm will receive a decided chill. This doubtless explains the attitude of many central-station men toward an energetic and general exploitation of electric cooking, for in most parts of this country the evening meal is the main repast of the day and a heavy cooking load would seriously augment the lighting peak in the winter months.

What is needed, then, to make electric cooking eagerly sought for from the central-station standpoint is some way to make it essentially off-peak in character. In the ordinary cooking devices where the current is applied only during the actual cooking process, the coincidence of considerable use during the peak is very likely, so hope does not lie in this direction. Three types of appliances have been developed, however, which give excellent promise along this line. These all embody the principle of heat storage in different ways.

The first of these is the electric fireless cooker. Although the fireless-cooker idea is by no means new, it is only in recent years that electric heating elements have been incorporated in them to obviate the separate preliminary heating of the dishes on a stove and to warm up the body of the cooker itself. The electric cooker, consequently, is extremely convenient besides being exact and highly economical in its results. When one has learned the relatively simple rules for using it, the results are highly satisfactory. There is no doubt that, if central stations took up the active exploitation of the electric fireless cooker, electric cooking would rapidly attain deserved popularity. In these cookers the current is used for a period of a half hour or so, and this period comes several hours before the meal, thus being almost wholly off the peak.

Through the ingenuity of Mr. William Stanley another type of appliance has been successfully developed. Two years ago he brought out his celebrated heat-storage range, a description of which was given in this journal at the time. On another page of this issue will be found a description of a newly patented and simplified modification of this appliance which Mr. Stanley has now made in a form corresponding to a disk stove for greater utility. The particular merit of this electric stove is that, instead of taking a heavy current for the relatively short period it is in actual use, it takes quite a small current continuously or over a long period of time, storing the heat meanwhile for the intermittent periods of active use. It thus acts as an electric heat accumulator which receives a slow and steady charge, thus making an almost ideal load. Even if a large number of such units were connected to a circuit at time of peak load, they would not add as much demand as a very much smaller number of heating appliances requiring direct application of heavy current.

Substantially the same principle that is used in the heat-storage range or stove is also employed in continuously operated water heaters for supplying various hot-water hydrants throughout a building. In the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of December 14, 1912, were given illustrated descriptions of several types of such heaters of foreign design. They have a small, continuous current consumption and the hot water is stored in a thermally insulated tank. Although not yet in anything like extensive use, they give promise of highly satisfactory results.

These three types of appliances, if not distinctively in the off-peak class, are at least not in the pronounced peak-raising class. To encourage their introduction this inherent advantage should receive recognition by special reduced rates. Such encouragement is given in many cities in England, notably those that have the half-penny cooking rate that has frequently been referred to in this journal. A special heating and cooking rate, however, means a special house circuit and meter, and for such special service a minimum monthly charge would seem to be required. If a sufficient number of customers can be secured in a neighborhood for such special service, it may even pay to run a distinct distributing circuit for the heating service and control this by a time switch that will open this line during the peak, thus insuring an absolutely off-peak load. Should a separate line be run for this purpose, it would be worth while to consider making it a plain two-wire 220-volt line with a new type of receptacle standardized for this service so that 110-volt lamps and other current-consuming devices not suited for exclusive off-peak supply could not be connected thereto. With a marked demand for 220-volt heating appliances the manufacturers will be only too ready to supply the goods. It must be remembered that in England, for example, the standard voltage is 220, and no difficulty is experienced on this account.

Program of National District Heating Association Convention.

The National District Heating Association will hold its fifth annual convention at Indianapolis, Ind., on May 27, 28 and 29. Headquarters will be at the Claypool Hotel, where there will be an exhibit of apparatus of interest to the members. The following program of papers has been prepared and the officers believe that it is of greater interest to those engaged in district heating than any other program ever before arranged.

The first session will be held on Tuesday at 10 a. m., at which general business will be transacted, reports read and an address delivered by the president. Among the reports to be presented are those of the Committee on Meters, by S. Morgan Bushnell, of Chicago; the Educational Committee, by E. Darrow, of Indianapolis; and the Committee on Station Records, by H. R. Wetherell, of Peoria, Ill.

At the afternoon session, papers will be presented by A. C. Rogers, of Toledo, O., on "Hot-Water Heating for Residence Districts," and by N. M. Argabrite, of Elwood, Ind., on "Possibilities of Hot-Water Heating."

At the morning session on Wednesday there will be papers by Charles F. Murphy, of San Francisco, Cal., on "District Heating on the Pacific Coast;" and by Norman G. Reinicker, of Detroit, Mich., on "Recent Improvements in Boiler-Plant Design and Operation." There will also be a discussion on "The Use of Bleeder Turbines."

At the afternoon session on Wednesday there will be papers on "Commission Control of Utilities," by D. L. Gaskill, secretary of the Ohio Electric Light Association, and "Appraisal of Heating Properties," by Harold Almert, of Chicago, Ill.

At the last session, on Thursday morning, there will be papers on "Is District Heating Profitable to the Central Station?" by C. J. Davidson, Chicago, Ill., and "Operating Economies in Heating Large Factory Buildings," by Edward L. Wilder, Rochester, N. Y.

On the evening of May 27 there will be a party at the Hume-Mansur Roof Garden, which will be repeated upon the evening of May 28, with the addition of a vaudeville entertainment. A theater party for the ladies on the afternoon of May 28 and an automobile ride to the Indianapolis Country Club on the following afternoon have been arranged. On May 30 the automobile races will take place in Indianapolis and it is expected that members will avail themselves of the opportunity to attend.

The president of the Association is R. D. DeWolf, of Rochester, N. Y., and the secretary is D. L. Gaskill, of Greenville, O.

Dr. Baekeland Receives Medal.

The Chicago Section of the American Chemical Society awarded the Willard Gibbs medal to Leo H. Baekeland at a dinner held on Friday evening, May 16, at the Hotel Sherman, Chicago, Ill.

Julius Stieglitz, chairman of the Chicago Section, acted as toastmaster, and after some preliminary remarks introduced W. D. Richardson, who, after briefly relating the achievements of the recipient, presented the medal to Dr. Baekeland. The latter was then called upon to speak, and after expressing his appreciation of the honor which was bestowed upon an industrial chemist for the first time, delivered an address upon the subject "Recent Developments in Phenolic Condensation Products." In connection with his address Dr. Baekeland exhibited a host of objects made of bakelite, including not only various forms of molded insulation but also buttons, parasol handles, pipe stems, ornaments, billiard balls, unbreakable dolls, sections of switchboard, etc.

Following this, short addresses were made by James R. Angell, dean of the University of Chicago, and George B. Frankforter, professor of chemistry in the University of Minnesota.

Telephone Pioneers of America.

The headquarters of the Telephone Pioneers of America, of which Theodore N. Vail is president and Henry W. Pope secretary and treasurer, have been removed from 30 Church Street to 15 Dey Street, New York City.

The annual meeting of the Pioneers will be held at Chicago, Ill., October 16 and 17, 1913. The committee on plan and scope for the entertainment to be provided for visiting Pioneers is composed of B. E. Sunny, president of the Chicago Telephone Company; Gerard Swope, and Angus S. Hibbard.

At a meeting of the Executive Committee of the Pioneers, held in New York City, May 8, 1913, C. R. Truex, H. S. Brooks, and C. E. Scribner were appointed a Committee on Membership, and at the same meeting John J. Carty, H. F. Thurber, and E. F. Sherwood were appointed a Committee to Consider and Recommend Changes in the Constitution and By-laws and to report at the next annual meeting.

The Association of Telephone Pioneers is rapidly increasing in membership, and the attendance in October next at Chicago promises to be very large, and will bring together early telephone toilers from all parts of America.

Annual Convention of Illuminating Engineering Society.

At a meeting of the Convention Committee of the Illuminating Engineering Society, held in Pittsburgh, Pa., Friday, May 16, it was decided to hold the next annual convention in Pittsburgh during the week beginning September 22.

The Convention Committee consists of A. Littlefield, New York Edison Company, chairman; P. S. Miller, Electrical Testing Laboratories, president of the Society; H. S. Evans, Macbeth Evans Glass Company, Pittsburgh, Pa.; W. A. Donkin, contract manager, Duquesne Light Company, Pittsburgh, Pa.; D. McFarlan Moore, General Electric Company, Harrison, N. J.; M. C. Rypinski, Westinghouse Electric & Manufacturing Company, New York; C. J. Mundo, General Electric Company, Pittsburgh, Pa.; J. C. McQuiston, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.; W. J. Serrill, United Gas Improvement Company, Philadelphia, Pa.; S. B. Stewart, Philadelphia Company, Pittsburgh, Pa.; T. J. Pace, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., and H. S. Hower, Carnegie Technical Schools, chairman of the local section of the society.

W. A. Donkin was selected as chairman of the Local Committee on Arrangements which will have charge of the convention. J. C. McQuiston was appointed chairman of the Publicity Committee and will make all arrangements for advertising the convention.

It is expected that several hundred engineers from all parts of the country interested in lighting in its various forms will be present, and the program, details of which have not as yet been completed, will consist, in addition to the technical sessions, of a reception and dance, and several excursion trips.

Entertainment for Ladies at Chicago Convention.

The feature of the entertainment at Chicago for the visiting ladies at the convention of the National Electric Light Association will be an automobile ride to Highland Park and return with luncheon at the Moraine Hotel, on Thursday, June 5. Automobiles and chauffeurs will be loaned by the public-spirited members of the electrical industry in Chicago for this occasion, and Godfrey H. Adkin, chairman of the Local Transportation Committee, 613 Marquette Building, will be glad to hear from any additional persons who are in a position to loan an automobile for this occasion.

The cars are to assemble in Grant Park east of the Van Buren Street bridge at 10 a. m., and will reach Chicago on the return trip about 5 p. m.

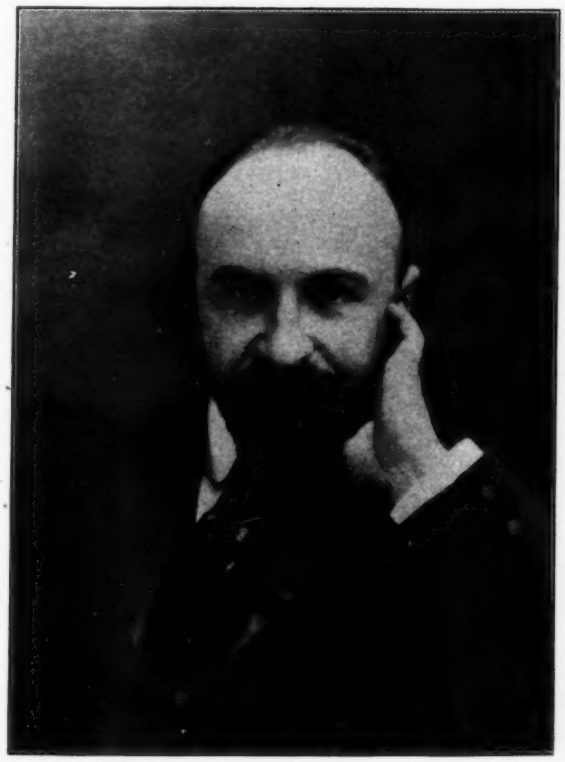
Leo H. Baekeland.

The Chicago Section of the American Chemical Society makes annually an award of the Willard Gibbs medal, which was founded by William A. Converse for achievement in chemical research. Heretofore the recipients of this medal have been men whose work has lain in the domain of pure science, namely, Theodore W. Richards and Svante Arrhenius. This year the distinction of receiving this award went to one whose field of activity has been industrial chemistry, one whose efforts although in the commercial field, have been of great and lasting benefit to his fellowmen. His latest achievement has been to supply the electrical industry with an insulating material which will no doubt be extensively used and which has been named after its inventor, "Bakelite."

Leo Hendrik Baekeland was born at Ghent, Belgium, on November 14, 1863. He is the son of Karel L. and Rosalia (Merchie) Baekeland. He studied at the University of Ghent, where in 1882 he received the bachelor's degree and in 1884, the degree of Doctor of Science. He later studied electrochemistry at the technical school in Charlottenburg, Germany. After returning to his native land he became assistant, and later, associate professor of chemistry in the University of Ghent. From 1885 to 1889 he was also professor of chemistry and physics in the Government Normal School of Science at Bruges.

In 1889 Dr. Baekeland came to the United States and continued investigations which he had already started into the chemical effects of light, with especial reference to photographic prints. The result of this work was the photographic paper, which has attained a world-wide reputation, known as "Velox." This was placed upon the market in 1893 by the Nepera Chemical Company, which carried on its commercial manufacture until 1899, when the company was absorbed by the Eastman Kodak Company, and Dr. Baekeland was left free for other work. He then continued his work in research and as a consulting chemist, and helped in the development of the Townsend electrolytic cell for the Hooker Electrochemical Company at Niagara Falls, N. Y. This cell is the basis for a commercial process of manufacturing caustic soda, which is now turned out and used in large quantities.

The attention of Dr. Baekeland was soon after attracted to the condensation products resulting from the reaction of phenols and aldehydes. Leaving the beaten track marked out by previous chemists, who sought to isolate through crystalization, fractional distillation, etc., such pure compounds as were found to result from this class of reaction, Dr. Baekeland proceeded to investigate the more troublesome compounds whose chemical composition is difficult of determination, and which form inert masses of unattractive material. The reaction of carbolic acid and formaldehyde was found, under certain well defined conditions, to produce a solid transparent amber-like substance devoid of odor and taste, which was christened "Bakelite," as a simple commercial name for the oxybenzylmethylenglycolanhydride. This was first described in a paper before the New York Section of the American Chemical Society in February, 1909.



Leo H. Baekeland,
Willard Gibbs Medallist for 1913.

There are three distinct and well defined stages in the process of obtaining this condensation product. The final product is hard, inert, unaffected by acids, alkalis or fairly high temperatures. There are two transition products, however, which are liquid or plastic in nature, thus enabling the material to be molded before reaching its final condition. It is necessary to heat the material in the transition stages in order to obtain the final product. Bakelite has been utilized in a great variety of commercial products, but is chiefly of interest to the electrical engineer as forming an insulating material which will stand high temperatures, has high insulation resistance and dielectric strength, and can be molded into any shape that may be desired.

Dr. Baekeland is the recipient of many medals, including the Nichols medal of the American Chemical Society and the John Scott medal of the Franklin Institute. He has served as president of the American Electrochemical Society and the American Institute of Chemical Engineers, and vice-president of the Society of Chemical Industry. He was president of the section on plastics of the International Chemical Congress, held at New York City in 1912. He has served as vice-president of the American Chemical Society and chairman of its New York Section, and is one of the directors of the Chemists' Club Building in New York City. He is a member of the Drug & Chemical Club, the University Club and the Chemists' Club of New York City, and has served as president of the latter.

Dr. Baekeland is the author of numerous papers on chemical subjects, dealing especially with photochemistry and electrolysis. He also published, in 1906, "A Family Motor Tour Through Europe."

Dr. Baekeland was married in 1889 to Celine Swarts. He makes his home in Yonkers, N. Y., and has a business office in New York City. He is president of the General Bakelite Company, which is engaged in the commercial utilization of his inventions and has licensed several other companies to market the molded insulation controlled by his patents, under various names.

Chicago Section, Illuminating Engineering Society.

At a well attended meeting of the Chicago Section of the Illuminating Engineering Society, held on the evening of May 14, M. Luckiesh, of the physical laboratory, National Electric Lamp Association, gave an illustrated talk and demonstration on "Light and Art."

International Engineering Congress.

The committee appointed by the five national engineering societies to conduct the International Engineering Congress in connection with the Panama-Pacific Exposition at San Francisco, in 1915, has effected a permanent organization. William F. Durand is chairman and W. A. Cattell is secretary-treasurer, with offices at 68 Post Street, San Francisco. Invitations to participate in the Congress will be issued to governments, engineering societies and individuals by a committee of ten, consisting of the presidents and secretaries of the five national societies, as follows: American Institute of Electrical Engineers, American Society of Civil Engineers, American Institute of Mining Engineers, American Society of Mechanical Engineers, Society of Naval Architects and Marine Engineers. The chairman of this committee is Charles F. Rand and the secretary is C. W. Hunt. The management of the Congress and the work of securing and publishing papers will be in charge of the members of the committee resident in San Francisco.

The papers presented at the Congress will be divided into sections and each section will hold independent sessions. The scope of the Congress has not been definitely determined, but it is hoped to make it representative of the best engineering practice throughout the world, and the papers are expected to constitute a review of the progress made during the past decade.

The representatives of the American Institute of Electrical Engineers upon the permanent Committee of Management are Ralph D. Mershon, F. L. Hutchinson, J. G. De Remer and A. M. Hunt.

Cut in Chicago Rates Proposed.

A report has been submitted to the Committee on Gas, Oil and Electric Light of the Chicago City Council by Ray Palmer, city electrician, which proposes reductions amounting to about $636,000 a year in the rates charged by the Commonwealth Edison Company. This report is the result of an investigation carried on by A. C. King, an electrical engineer, and Charles B. Willard, an expert accountant, in conjunction with Mr. Palmer.

The report regards seven per cent as a fair return on the invested capital and it has been found that the company is earning a considerable surplus in excess of this amount. The proposed rates have been chosen with the expectation of eliminating this.

The report recommends no change in the maximum charge of ten cents net per kilowatt-hour. It proposes changes in the secondary and tertiary rate, and the making of these the same to all consumers, ragardless of whether current is used for light or power.

The appraised value of the property of the company on June 30, 1911, is given as $57,983,558, of which $3,247,679 is intangible value, and $2,535,690 is working capital. The capitalization of the company was approximately $10,000,000 in excess of the appraised value and has since been increased to approximately $72,000,000. The annual gross earnings are stated to be about $14,000,000.

The report is based on the appraisal made by H. M. Byllesby & Company in 1908, with modifications necessary to bring it up to date.

Railroad-Car Illumination.

At the regular monthly meeting of the Pittsburgh Section of the Illuminating Engineering Society, on May 16, J. L. Minick presented a paper on "Illumination of Passenger Cars." He traced the developments in the methods of car lighting that have been witnessed since 1825 when the candle was the source of light employed. Various types of oil, gas and electric lamps which have been in general use were described and illustrated by lantern slides, together with the fixtures and shades used with them. Illumination curves and data sheets were presented for cars lighted by the more modern types.

In the discussion, which was entered into by Messrs. Searle, Millar, Littlefield, Porter, Morrison, Cotton, Kirshberg, Ryder, Doane and the author, the following points were brought out: On account of the fire risk, the Pennsylvania Railroad limits the use of the New York tunnels to all-steel cars equipped with electric light. Car batteries are mostly of 300 ampere-hours capacity. The demand runs from three or four amperes in an express or baggage car to as high as 45 amperes in dining cars. Indirect or semi-indirect lighting is recognized as being desirable for this service, but at present the battery equipment does not have sufficient capacity to allow it, and still maintain the present standard of three foot-candles. The taking of illumination readings at an angle of 45 degrees to the horizontal, as well as on a horizontal plane, was recommended, as giving results that would correspond more closely to actual conditions of reading, but it was pointed out that no set of readings, however complex, can be depended on without the use of judgment with respect to local conditions.

There are at present three methods of obtaining current for car lighting.

The difficulty with the straight battery method is that if any lamps are on when the battery is being charged they are liable to be burned out; also the voltage regulation is bad. This method is going out of use rapidly. In the head-end system the power is supplied from a generator driven by a small engine or turbine in the baggage room or on the locomotive. The difficulty here is that cars of the train must be wired for the same system, which is at times difficult to secure; also the generator is at the mercy of the engineer, who is liable to cut off the steam. Everything seems to point to the more general adoption of the axle generator.

Electrical Club of New Orleans.

The Electrical Club of New Orleans was organized on April 1 at a meeting held in the St. Charles Hotel in that city. The following officers were elected and are now arranging details of organization: president, Ben Willard, local manager of the General Electric Company; first vice-president, S. Barnes, of the Barnes Electric Construction Company; second vice-president, Chauncey French, of the Woodward-Wight Company; secretary, T. S. McLoughlin; treasurer, W. Conery, Federal Sign System. The chairman of the Membership Committee is F. W. Stevens, Allis-Chalmers Manufacturing Company.

One of the objects of the club is to secure permanent headquarters, constituting a first-class social club in a prominent location. It is also contemplated that these headquarters will be in a building in which other organizations of electrical men will be centered. The membership is to be drawn from three classes: (1) active members, consisting of those actively engaged in the electrical industry; (2) associate members, consisting of those engaged in lines allied with the electrical industry; (3) non-resident members, comprising out-of-town men who would come under the qualifications of classes (1) and (2). The initiation fee for the first two classes will be $25, and the annual dues $25; for the third class, the initiation fee will be half as great, and the annual dues will be $12.

New Officers of Telephone Society.

The president of the Telephone Society of New York appointed a Nominating Committee, which has presented the following nominations for officers and members of the Executive Committee for the following year: president, D. C. Cox; vice-president, F. B. Jewett; secretary-treasurer, R. S. Scarburgh; Executive Committee, G. L. Yates, I. J. Thorpe, P. O. Coffin, F. W. Lienau, C. A. Merrill and L. F. Morehouse.

The election took place at the meeting on Wednesday evening, May 21.

Electricity in Packing Plants.

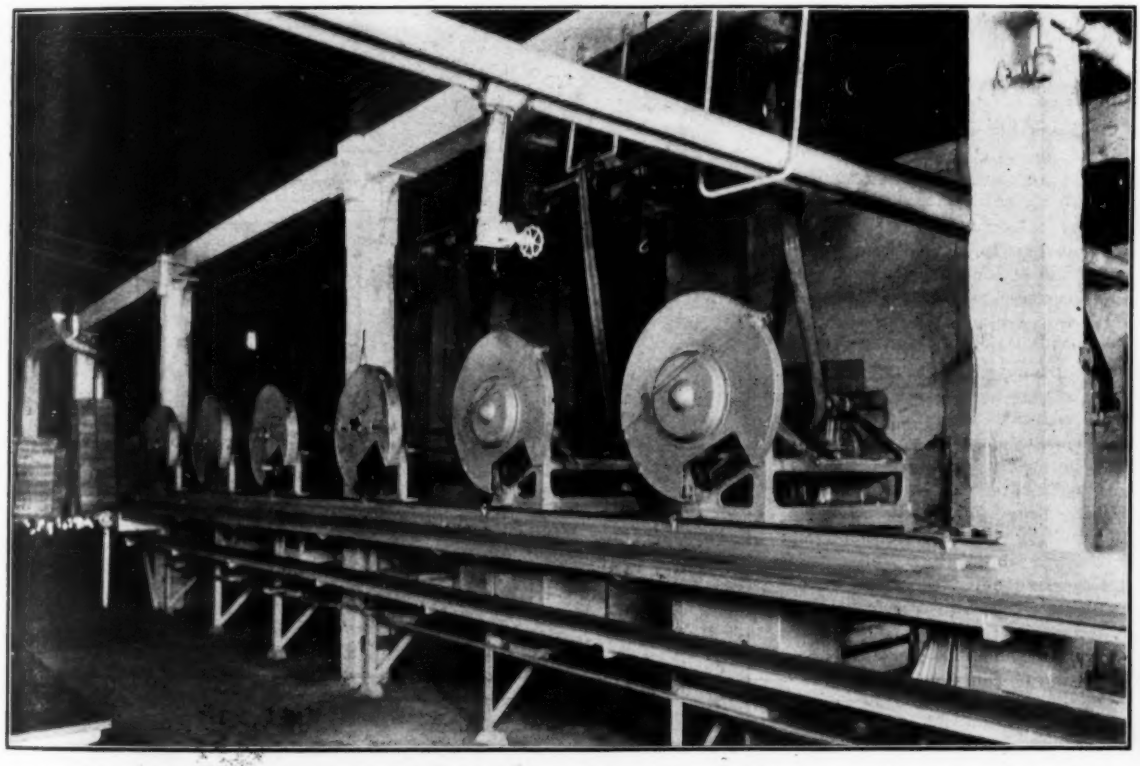
While under present conditions, it is perhaps impossible for central stations to supply all power required in the very large packing plants, still there are hundreds of instances where an economy can be effected by purchasing energy and even the largest plants offer opportunities for the sale of some power. Examples of both conditions are given herewith.

While it is universally acknowledged that electric drive must supersede the time-honored mechanical drive in the packing industry, there is considerable question as to the economy of purchased power, inasmuch as steam and hot water is required in many of the operations involved. Certainly a central-station company, under average conditions, cannot hope to supply the entire power required in such mammoth establishments as Swift's or Armour's at Chicago, but there are many smaller plants, now operating steam power stations, that could profitably purchase energy. And in all cases, even where unusual attention has been given the power proposition and where efficient and economical operation is being obtained, central stations should not ignore these plants as hopeless prospects, but an effort should be made to supply part power for operation on certain days of the week; for overtime service; or for operating additional machines that may be added to the original equipment. This practice is carried on in Chicago, Omaha and elsewhere with excellent results. The business is profitable, but of greater importance is the fact that in case of breakdown or any emergency the central station will be able to demonstrate that cost is really secondary to reliability of service.

It is almost universally true that the engineering in most packing houses is looked upon as a necessary nuisance and expense. In fact, it would appear to be so considered in most industrial establishments, except those wherein the character of the work of manufacture is largely of an engineering nature, and therefore entered into and understood by those financially interested. It is, moreover, too frequently true that much of the so-called engineering is not what it should be, is needlessly expensive and not productive of the best results. Regardless of reduction in power bills, therefore, central-station power should find a wide application in this field and at the same time, the manufacturer will have greatly improved his power conditions.

The consideration of electric power for use in packing plants brings to the central-station engineer many of the same problems which come to him for solution when its use is under consideration for other kinds of industrial establishments. It may be said in general, however, that the conditions in many ways are more trying than in almost any other class of service. It does not require such great refinement as is necessary in other lines of manufacture, but a system of power distribution, to be suitable for a packing plant, must be thoroughly reliable.

The saving which can be effected by the use of electricity for power purposes varies greatly with different plants and depends, of course, on the size and arrangement of the plant under consideration. A thorough canvass of the establishment should be made and the present as well as the possible future conditions carefully weighed. Any comparison of econo-



Six Dried-Beef Slicers and Belt Conveyor, Motor-Driven, in Plant of Cudahy Packing Company, South Omaha, Neb.

mies should embrace not only the saving in fuel but should also include the relative costs of repairs and maintenance for the two systems.

Of the plants now operating with mechanical transmission, the larger ones and those most complex or widely scattered would naturally derive the greatest benefit by adopting central-station power. In such plants, the transmission is usually more complicated, changing floor loads make it more difficult to keep shafting in line, while developing conditions make frequent modifications and extensions to the transmission equipment necessary. To save time and expense, these changes are often knowingly made, not in a manner to get the most economical results, but in a way that will do for the time and avoid interruptions to business. In a packing plant it is essential that things be kept moving, and frequently unfortunate compromises are made in the machinery arrangements to accomplish this end.

It is a common occurrence that not all the departments of such a plant are operated continuously or simultaneously, therefore, in plants using mechanical drive it is necessary to operate the entire engine equipment if it is only desired to run one or two machines. A carefully determined and suitable arrangement of electric motors permits any or all departments to be operated at will, without the loss due to operating needless transmission equipment.

In a prosperous concern some departments develop, perhaps even reaching such proportions that it may become necessary to re-locate them. Another department shrinks or may be found to occupy space which could be used to better advantage for some other purpose. It is often found awkward to arrange anything like a good and economical plan for distributing power with shafting and belting, and departments are frequently, therefore, necessarily kept in awkward relations on this account, it being too expensive to re-locate them. With mechanical transmission it sometimes happens that the location of the power plant is a compromise or makeshift arrangement, brought about by the necessity of getting at the main lines of shafting. It may occupy space which could and naturally would be used to good advantage for productive purposes. The elimination of the innumerable belts inseparable from mechanical drive also increases safety to operatives, eliminates dirt, which is of paramount importance in plants manufacturing food products, and in addition greatly improves lighting conditions.

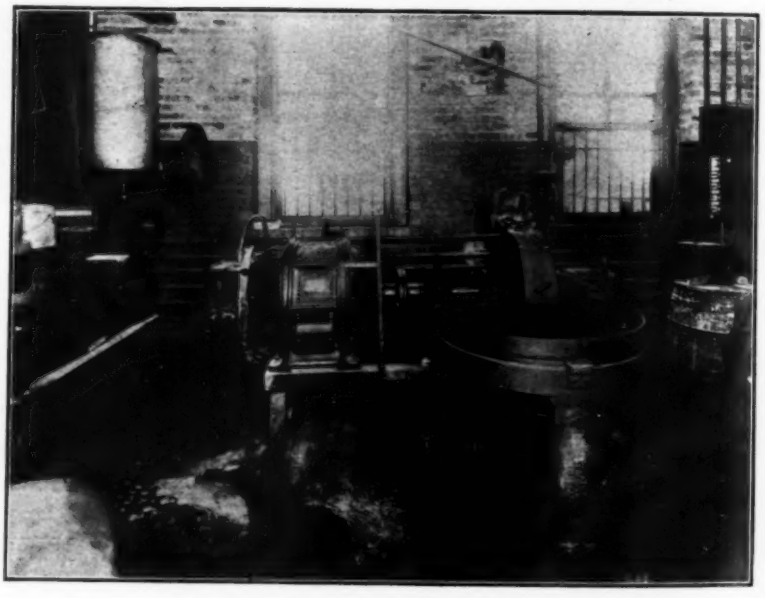
With motors, if group drive is adopted, belt speeds are usually higher and the belts consequently smaller. The motors are placed on ceilings, walls or floors, as may be most convenient, and drive in any direction, thus permitting arrangements to be made, which are best suited to the various conditions. The controlling switches should be placed convenient for use in starting or more especially in stopping, should accident occur which requires prompt action in shutting down the machinery. At the same time they should be located where least liable to damage.

Motors, especially alternating-current machines, have from experience been found to require little if any more attention than the transmission machinery which they replace. The alternating-current motor is simpler in construction than the average packing-house machine, and having but a rotating motion with no rubbing parts, has little to get out of order. It has stood up, with reasonable treatment, under the trying conditions in packing plants—steam, heat, ammonia, grease, varying loads and long hours.

It is true of the meat-packing establishments of this country that the advantages of individual motor drive are not at present fully understood. As a matter of fact only the more recently constructed plants have employed individual drive to any great extent. It is difficult to estimate the saving in power which can be effected by changing from group to individual drive, but

(Continued on page 1046)

7.5-Horsepower Induction Motor Driving Six Oil Presses.



Silent Cutter With Direct-Connected Motor.

Packing-Plant Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors and other apparatus connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Meat packing plant killing an average of 200 hogs per week. An ice machine in conjunction with the plant is in operation during the summer months.

Total connected horsepower, 90. Total number of motors installed, 4. Average kilowatt-hours per month, 3,760.

Kilowatt-hour consumption for 12 months: January, 860; February, 1,290; March, 980; April, 5,930; May, 5,200; June, 7,070; July, 7,080; August, 7,350; September, 4,780; October, 2,860; November, 860; December, 860.

Load-factor, 7.6 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power	Speed R. P. M.	Application.
1	20	1,120	Belted to a four-foot shaft (two hangers) and a four-hanger countershaft driving one link-belt hoist, 12-foot lift; one 12-foot by 62-inch diameter revolving hog scraper.
1	20	1,120	Belted to 24-foot shaft (five hangers) and one two-hanger countershaft driving one Enterprise No. 66 sausage grinder; one Buffalo No. 38 sausage grinder; one Boss No. 2 sausage mixer; and one 16-inch by 3-inch revolving bologna cutter.
1	10	1,200	Belted to 12-foot shaft and two-hanger countershaft driving one Brecht lard machine; one J. E. Smith lard mixer.
1	40	1,120	Belted to a York duplex 20-ton ammonia compressor, operating at 75 revolutions per minute.

All motors are of the squirrel-cage induction type.

Packing and sausage plant operating 144 hours in summer and 72 hours in winter.

Total connected horsepower, 122. Total number of motors installed, 6. Average kilowatt-hours per month, 14,965. Average kilowatt-hours per month per connected horsepower, 12.5. Measured maximum demand, 67 kilowatts.

Kilowatt-hour consumption for 12 months: January, 13,420; February, 8,700; March, 10,150; April, 13,569; May, 15,250; June 2,840; July, 20,310; August, 22,310; September, 22,629; October, 18,240; November, 14,360; December, 15,810.

Load-factor, 23 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power	Speed R. P. M.	Application.
1	50	900	Belted to a countershaft driving two two-ton Wolf-Linde ice machines. The pumps for supplying the cooling water are driven from above countershaft; it is necessary to pump the water only from the coils to the cooling tower.
1	5	1,200	Slip-ring motor geared to mechanism of a 2,500-pound flat form type freight elevator.
2	7.5	1,120	Each motor belted direct to a meat grinder, capacity about 300 pounds per hour per machine.
1	2	1,200	Belted direct to air compressor, 50 feet per minute, supplying air to sausage stuffers.

Meat packing plant.

Total connected horsepower, 83. Total number of motors installed, 7. Average kilowatt-hours per month, 8,759. Average kilowatt-hours per month per connected horsepower, 105.5.

Kilowatt-hour consumption for 12 months: January, 11,909; February, 4,231; March, 7,442; April, 6,487; May, 8,074; June, 9,142; July, 11,452; August, 10,111; September, 12,343; October, 8,823; November, 7,737; December, 7,356.

Load-factor, 19 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 500 volts, direct current.

No.	Horse-power	Speed R. P. M.	Application.
1	30	1,235	Belted direct to one 15-ton duplex refrigerating machine.
1	25	1,275	Belted to a line shaft driving one No. 2 Boss mixer; one No. 40 silent cutter; and one No. 166 Enterprise grinder.
1	5	1,030	Geared to one Standard deep-well pump.
1	2.5	1,725	Belted to Curtis air compressor, 60 to 80 pounds pressure.
1	0.5	300	Direct-connected to one three-foot ventilating fan.
2	10	900	Each driving mechanism of 1,500-pound freight elevator.

Size of cooling rooms:

1—52 ft. by 14 ft. by 8 ft. high; 36 to 40 deg.
1—25 ft. by 12 ft. by 8 ft. high; 36 to 50 deg.
1—34 ft. by 12 ft. by 8 ft. high; 36 deg.
1—56 ft. by 42 ft. by 12 ft. high; 35 deg.

The refrigerating machine averages 15 hours operation in summer and 9 hours in winter. The direct-expansion system is used. Back pressure 20 pounds to 35 pounds, condensing pressure 135 pounds to 205 pounds.

Packing-Plant Data—Sheet No. 2.

Small packing plant. Operating time varies.

Total connected horsepower, 67.5. Total number of motors installed, 4. Average kilowatt-hours per month, 1,030. Average kilowatt-hours per month per horsepower connected, 15.

Kilowatt-hours per month for 12 months: January, 1,070; February, 1,000; March, 1,240; April, 1,190; May, 1,090; June, 880; July, 920; August, 930; September, 1,140; October, 920; November, 1,110; December, 880.

Load-factor, 2.8 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts. Squirrel-cage induction motors are used.

No.	Horse-power	Speed R. P. M.	Application.
1	35	900	Geared to one fertilizer tank, capacity 90 head offal. Tank is of special construction.
1	5	1,200	Belted direct to one agitator mixer on tallow tank.
1	7.5	1,200	Belted direct to one hog hoist, capacity 200 hogs per hour.
1	20	1,200	Belted direct to four hoists for raising cattle from floor to racks.

Meat packing plant running 144 hours per week. Two ice machines are installed, the smaller one being used in winter. 45 men work in the day shift and 14 at night.

Total connected horsepower, 75. Total number of motors installed, 6. Average kilowatt-hours per month, 14,195. Average kilowatt-hours per month per horsepower connected, 189.2.

Kilowatt-hours per month for 6 months: July, 13,252; August, 12,524; September, 19,373; October, 14,062; November, 13,912; December, 12,049.

Load-factor, 35 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is two-phase, 60 cycles, 440 volts.

No.	Horse-power	Speed R. P. M.	Application.
1	7.5	1,130	Belted direct to a one-ton Remington refrigerating machine.
1	30	850	Belted direct to one 15-ton De La Vergne ice machine.
1	5	1,720	Driving one Standard Pump & Engine Company deep-well pump, 3.75-inch working barrel, 24-inch stroke, 65-foot well.
1	15	620	Belted to line shaft driving one No. 2 Boss mixer; one No. 32 J. E. Smith silent cutter; and one No. 56 Enterprise sausage grinder.
1	7	1,100	Driving one 2,000-pound freight elevator.
1	3	900	Belted to a lineshaft driving one 12-inch Champion blower, 2,400 revolutions per minute; one 5 by 6-inch Dean air compressor, 80 pounds pressure; one 11-inch engine lathe; and one grindstone.
1	7.5	1,120	Driving 2,000-pound freight elevator.

Size of cooling rooms:

2—64 ft. 6 in. by 22 ft. 2 in. by 14 ft. high; 32 deg. to 40 deg. Fahrenheit.
2—33 ft. 4 in. by 14 ft. by 7 ft. high; 40 deg. Fahrenheit.
1—12 ft. by 14 ft. by 7 ft. high; 40 deg. Fahrenheit.
1—28 ft. by 30 ft. by 7 ft. high; 32 deg. Fahrenheit.
1— 8 ft. by 7 ft. by 7 ft. high; 32 deg. Fahrenheit.

Small packing plant operating 42 hours per month.

Total connected horsepower, 10. One motor is installed. Average kilowatt-hours per month, 1,057.

Kilowatt-hour consumption for 11 months: January, 12; March, 1,476; April, 1,761; May, 1,889; June, 1,478; July, 1,478; August, 1,137; September, 2,065; October, 1,231; November, 144; December, 20.

Load-factor, 19.4 per cent.

MOTOR INSTALLATION.

The supply source is 500 volts, direct current.

No.	Horse-power	Speed R. P. M.	Application.
1	10	1,400	Motor is belted to a countershaft driving one seven-ton Althoff ice machine. Ice box has a capacity of 40 head of cattle and 12 tons of lard, maintaining an average temperature of 38 degrees.

conservative engineers have asserted that group drives require from one-half to four times the energy taken by the machines themselves. With individual drive the maximum power is effective on the machine itself and the belts, pulleys, and shafting which are indispensable to the group system are eliminated. In addition to the economy of power made possible by this method of application, operatives are frequently able to secure an increased production, due to the greater ease of control and more accurate speed regulation.

Artificial refrigeration has probably been the most important factor in building up the year-round packing business as it is now conducted. Previous to the introduction of these machines only local markets were supplied with fresh meats during the warm weather. Steam-driven compressors were, therefore quite generally installed before the electric motor had come into prominence for industrial uses. Newer packing-house equipments which have been primarily designed for electrical operation have utilized the electric motor for driving refrigerating machines, thus entirely removing the necessity for high-pressure steam. Low-pressure boilers are usually more efficient for furnishing steam for washing and heating purposes, and in the case of old plants changed over to electric drive the old steam boilers may be used for this purpose even after they have become useless as high-pressure units.

When applying direct-current motors to refrigeration compressors, it is preferable to use compound-wound motors, in view of the heavy starting

torque required and the cylic variation in load. When applying alternating current, the smaller sizes of compressors can be operated with squirrel-cage motors, while the larger machines will usually require a wound-rotor motor on account of the high starting torque required.

The power required to drive a refrigerating machine depends to a great extent upon the temperature of the water used to cool and liquefy the compressed gas. The lower the temperature of the water, the smaller the amount of power required.

It has been found that, under proper conditions, one ton of refrigeration will cool from animal temperature to keeping temperature

	Weighing
From 15 to 24 hogs	250 pounds each
From 5 to 7 beeves	700 pounds each
From 45 to 55 calves	90 pounds each
From 55 to 70 sheep	75 pounds each

After cooling, one ton of refrigeration will preserve one ton of meat for 24 hours, when stored in proper boxes.

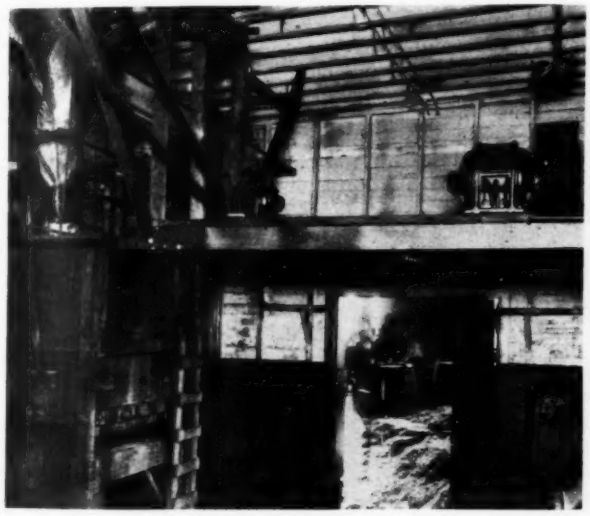
APPROXIMATE HORSEPOWER REQUIRED TO DRIVE REFRIGERATING COMPRESSOR.

Capacity, Tons Refrigeration	Horsepower Motor Required
0.5	2
1	3
2	5
4	7.5
5	10
7.5	15
10	15
15	25
20	35
30	50
40	65
50	80

It is difficult to state definitely the exact sizes of motors required for the many purposes throughout packing houses on account of the various sizes and makes of machines, and the method of operating and arranging them. These are details which should be carefully studied and receive the best attention in planning an electrical system of power distribution for any specific case. Success and economy depend, to a considerable extent, upon the right subdivision, arrangement and installation.

In general it is desirable that the number of different sizes of motors be kept as low as is consistent with the requirements. In most plants the requirements for sizes would run from 1 to 30 horsepower. Seldom need the motors be larger, and it is advantageous not to use much larger units if they can be avoided.

It is essential to arrange the motors and drives so that the system will be flexible, that the machines usually operated together can be driven with one motor, if it does not require too large a one, and that all motors shall be of such sizes as to be well loaded when operated under normal working conditions. Machines used intermittently should be separately driven, so they can be shut down when idle.



Five-Horsepower and Ten-Horsepower Motors Belted to Washing Machines. Five-Horsepower Induction Motor Geared to Hog Hoist.

It is frequently desirable to use a flywheel on the shaft of the motor or the machine which it drives, in order to equalize rapidly changing loads, and thus improve the conditions under which it operates. The flywheel under these conditions tends to decrease the size of motor required. They are desirable in connection with elevators, crushers, saws and grinders, where the irregular loads impose severe and trying conditions on the motors driving them.

Motors which are subject to extreme dust or moisture conditions should be boxed or housed. Where it is necessary to place a motor in an atmosphere filled with dry tankage or fertilizer, it should be surrounded with a tight box. A motor driving a group of hog-casing machines or a pump for a hydraulic tankage press, and located under the usual conditions surrounding such apparatus, should be placed in a waterproof box.

German Electrical Manufacturing Industry.

According to a report just issued by the German Union of Electro-Technical Manufacturers, the past year was a good one for the industry, the marked increase in the adoption of electricity for lighting and power purposes reflecting itself in increased turnover by most members of the union. Profits, however, chiefly owing to the advance in metal prices, were not always satisfactory. The union includes almost all the German electrical companies outside the A. E. G. and Siemens-Schuckert groups. Makers of motors were well employed, but unfortunately it was only possible to obtain better prices for those of upward of five horsepower. The cable branch of the industry had little reason to complain, for owing to the efforts of the cable cartel prices were brought to profitable levels. Foreign competition was very keen. Prices of insulated wire, which were very unsatisfactory in 1911, were improved, producers coming to a price agreement. Toward the close of 1912 a price cartel was formed with regard to insulating tubing, the manufacture of which had become quite unprofitable. There was a slight improvement in the arc-lamp trade owing to the introduction of new and improved types, but the incandescent-lamp trade left much to be desired. The German tax on lighting apparatus is seriously handicapping both the home and foreign trade. Owing to the customs practice in the United States and Canada of including the German lighting tax as part of the basic price on which to impose their own ad valorem import duty, it is now proving quite impossible to export German electric lamps to these markets.

Commercial Practice
Management, Rates, New Business

Power Economies in a Printing Plant.

The following facts and figures are taken from a recent report of an investigation of the cost of electricity and of the operating conditions in a printing plan located in an eastern city. The plant consists of three buildings: A, B, and C. The first is a three-story wooden structure containing the offices, storeroom, bindery, composing and shipping rooms, and requires no power. Building B is of brick, three stories in height, and is connected with A by a passageway at the level of the second floor. All the power-operated machines used in printing are installed in this building. Building C adjoins B and is of brick, one story in height, and contains the engine and boiler rooms. A part of the engine room is used as a machine shop.

The first floor of building B is comprised of a stock room and a room containing several machines, two being driven by a main shaft extending the length of the room. The line shaft on the second floor is sectionalized in two parts, each being driven from the heavy shaft of the floor below. Only light machines are installed on the third floor, such as job presses and stitching machines.

The following is a list of machines installed in building B:

First Floor.

Perforating machine.
Board cutter.

Second Floor.

Two Lanston monotype machines.
Air compressor.
Small Huber cylinder press.
Two large Huber cylinder presses.
Two small Hoe cylinder presses.
Five Cottrell cylinder presses.
Chambers folder.
Chambers automatic folder.
Hercules book machine.
Dooley paper cutter.

Third Floor.

Three Universal 13 by 17 job presses.
Two Prouty 10 by 15 job presses.
Golding 8 by 12 job press.
Marsh taped-end paper machine.
Acme cutter.
Oswego cutter.
Book stitcher.
6-9 Singer sewing machine.
Smyth sewing machine.
Chambers folder.
Three Campbell 2-ft. folders.
Four perfection wire stitchers.
Stonemetz folder.
Crawley book machine.
National cutter.
Gathering machine.

Machine Shop.

Lathe.
Planer.
Drill press.
Emery wheel.
Knife grinder.
Wood saw.
Small blower.
Boiler feed pump.

The steam plant consisted of a horizontal multitubular boiler generating steam at about 80 pounds pressure for a 60-horsepower Swampscott engine of the single-expansion type, equipped with a Corliss valvegear, and running at approximately 86 revolutions per minute. The steam, after passing through the engine, flowed through a feed-water heater and a separator before exhausting into the air or the heating system. Coal was delivered in wagons. Boiler feed water was taken from the city mains, and was forced into the boiler by an injector or a pump after it had passed through the feed-water heater. The return from the heating system discharged into the sewer. The buildings were lighted principally by electric lamps, although a small amount of gas was used. A 7.5-horsepower, 125-volt generator was belted to the engine when lighting was required. At the time of the test the dynamo was run at about three-quarter load.

Preparatory to the test, a calibrated voltmeter and an ammeter were inserted in the generator circuit at the switchboard, permitting the reading of the lighting load. The fuel used was a mixture of two parts of bituminous coal and one of screenings.

An all-day test and five special load tests were made. The all-day test began at 5 a. m. and continued throughout the day until the boiler was banked for the night. During this time the feed water was weighed and the temperature taken; the boiler-room temperature was observed; a sample was taken of every shovel of coal thrown into the boiler; the flue gas was sampled and tested every hour during the test; steam indicator cards were taken every fifteen minutes while the engine was running. The readings of the steam gauge placed at the engine were valueless on account of the needle jumping considerably at each stroke of the engine, and the pressure of the steam at the cylinder was assumed the same as that of the boiler, the connecting pipe being short and well lagged. The quality of the steam was taken at only one point, the pipe over the engine cylinder. Calorimeter measurements were made every hour.

The next day a test was made to determine the power used by each of the large presses. This was accomplished by taking indicator cards while there was a constant load on the third floor with all the presses running on the lower floor, and then shutting down the presses one at a time. Another test was made to find the amount of power used by the shafting, which was done by taking cards with the engine driving the shafting only. The value includes the engine friction, but as the main belt could not be removed a value was assumed for it in the calculations. The power used by the generator was obtained by taking cards while the dynamo was running alone and subtracting the power obtained in the former test. A test was made to obtain the normal top-floor load in a similar manner to that giving the generator load in the previous test. The power used by the elevator was obtained by tests made for the elevator going both up and down. The heating value of the coal was found by means of a Mahler bomb calorimeter. Some of the coal was lost through the grate without burning and an attempt was made to determine the amount. A sample of ash was taken, weighed, and the coal burned out in a platinum crucible. After about six hours a constant weight was obtained. The difference in the weight after drying and that after burning was observed, and knowing the percentage of ash in the coal the amount of coal lost was easily calculated.

The storage capacity for fuel was limited, and the coal was bought in small quantities as it was required for use. The rate of consumption between two dates upon which new supplies were delivered was found and a consumption curve plotted for a year, as shown by Fig. 1. The load curve of the plant would be generally similar. The plotted curve shows a light season of three months and a heavy midwinter peak. It should not be forgotten that in cold weather a part of the coal was used in heating the plant outside of working hours and that the additional power requirements for the winter season would be somewhat smaller. Table I shows the results obtained from the tests.

The fixed charges were based on a total cost of $3,500, distributed as follows: 60-horsepower engine, and main belting, $2,000; boiler, with setting and piping, $1,500. Allowing five per cent

each for depreciation and interest, and two per cent for insurance and taxes, there is a total of 12 per cent or $420.

TABLE I.—TEST RESULTS.

Total coal lost through grate per day, pounds	54.8
Water evaporated per pound of coal, pounds	6.75
Per cent heat lost in stack	28.3
Boiler efficiency, per cent	64.3
Average indicated horsepower of engine	32.3
British thermal units per minute per indicated horsepower	963
Steam per indicated horsepower per hour, pounds	48.3
Engine efficiency, per cent	4.41
Rankine efficiency, per cent	11.6
Per cent Rankine efficiency attained	38.0
Transmission efficiency, per cent	68.2
Annual Cost of Operation.	
Fuel: 215.19 tons bituminous coal and 77.85 tons screenings	$ 989.79
Water	149.70
Labor, one engineer	1,040.00
Oil and waste (estimated)	50.00
Repairs, etc. (estimated for plant only)	50.00
Lamp renewals (estimated)	12.00
Insurance on boiler	15.00
	$2,306.49
Fixed charges	420.00
Total operating expense	$2,726.49

An examination of the results showed that a considerable amount of the coal was lost through the grate, which at a rate of $3.00 per ton, as the fuel lost was mostly screenings, amounted to about $27.00 per year. The loss of heat in the flue gases could not be prevented as it would not pay to install an economizer in a plant of this size. The analysis of the flue gases showed that the combustion was practically complete. The boiler efficiency was low, but as the plant was old and had not received the best of care the value was about what would be expected. Both the British thermal unit per horsepower and the steam consumption were excessive, the latter being caused by a leaky piston and valves. Consequently the efficiency of the engine was low. The shafting consumed about 30 per cent of the power supplied.

The expense for coal and water, and the labor cost, were taken from the bills of the previous year in figuring the cost of operation. The items of oil and waste, and repairs, were taken from the actual cost in plants of about the same size as the one under consideration, since no figures were available. The insurance was the -ctual cost of the boiler insurance alone. The fixed charges were figured on the basis of a plant renewal once in twenty years.

The following installation of a group drive operated on central-station service was recommended on account of combining most effectively low first cost and small power consumption:

Induction motors attached to ceiling and belt-connected to line shafts.

First Floor.—One 7.5 horsepower motor, 1,200 revolutions per minute, to operate elevator and board cutter.

Second Floor.—Two 15-horsepower motors, 1,200 revolutions per minute, each to operate a section of the line shaft.

Third Floor.—One 5-horsepower motor, 1,800 revolutions per minute, to operate the entire floor.

It was further recommended, in order to reduce the lighting load, that all carbon lamps should be replaced by tungsten lamps of the same candlepower. The sizes of the motors were determined by a study of the indicator cards taken during the special runs and by an estimation of the division of the load. The motors would run normally at slightly less than one-half load at an efficiency of about 85 per cent, a value obtained from actual motor curves. The load of the plant consists principally of the large cylinder presses on the second floor which require speed adjustment that is obtained by means of step pulleys. The available power service is alternating current and speed regulation by alternating-current motors could be obtained only by the use of the present step-pulley system or by an inefficient friction-disk equipment. Individual drive would require about double the horsepower capacity needed

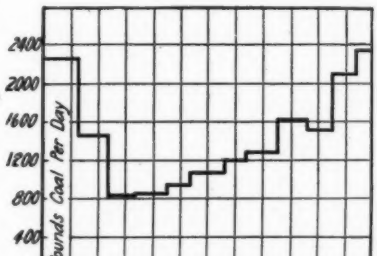


Fig. 1.—Coal-Consumption Curve.

with the group drive and the cost would be in even greater proportion; consequently there would be no final saving by the use of separate motors.

The changes recommended in the present system of shafting and belting include the removal of the short countershaft on the third floor, the belts between the first and second, and the first and third floors, the engine, and all belts and shafting on the first floor except the two small counter shafts serving the elevator, board cutter and perforating machine. The Dooley paper cutter on the second floor receives power from a countershaft on the first floor which would be transferred to the second and be driven from the main shaft on that floor. The perforating machine would be driven from the same countershaft as at present, but the driving pulley would be relocated on the second floor. The generator would be removed and light furnished by central-station service. The 7.5-horsepower motor on the first floor would serve, when required, the elevator or the board-cutting machine. Only one of the 15-horsepower motors on the second floor would be needed to run continuously during the season of low plant output, and if a rearrangement of machinery could be made so that all necessary operations could be carried on at one end of the building, a single motor would undoubtedly carry the entire summer load.

The following estimate of the operating expense with an electric drive is based upon the results of the tests, calculations, reasonable assumptions and upon a comparison with other printing plants of similar size operated by electricity.

Power.—The results of the special and the all-day engine tests show that the entire friction load of the plant was 21 indicated horsepower. The friction of an old engine of this type is about 10 per cent, being equivalent to 6 horsepower. It was estimated that 5 horsepower was lost in the main belt, the intermediate belts leading to the second and third floors, and in the first-floor shafting, all of which would be eliminated by the use of electric power. The indicated horsepower is therefore 11 horsepower greater than the necessary motor output. The average indicated horsepower from all the cards taken during the all-day test while the generator was not running amounted to 27.8 horsepower, giving 16.8 horsepower ($27.8 - 11.0 = 16.8$) as the motor output for a winter day. The output is reduced to about 60 per cent of its normal value during the light summer season of three months. The hours of operation are 8.5 per day for the entire plant, with an additional hour at a load of about 3 kilowatts for the third floor. An allowance of 1 kilowatt-hour per day was made for the elevator and the board-cutting machine. Taking the motor efficiency as 85 per cent, and 25 working days in a month, the annual motor load will amount to 34,939 kilowatt-hours. The load-factor for the all-day run not including the period when the generator was running, corrected for excess of friction with a steam drive, in order to make it applicable to the electric service, amounted to 68.6 per cent. From a schedule of the power company, using the above values for the power consumption and the load-factor, it was found that the current would cost about 4.03 cents per kilowatt-hour, making the total annual cost of power $1,407.51.

Labor.—It would be necessary for the company to retain one man to attend to the heating system during the winter, and to make repairs throughout the year. These duties would not require more than one-third of his time, and the remainder would be available for other employment not relating to the power plant. Therefore allowing one-third of a man's time at $18.00 per week, the labor cost amounts to $312.

Heating.—The present boiler fitted with a safety valve and a piping system with a gravity return would be used for heating. A licensed engineer would not be required to operate the boiler, and there would not be any insurance charge. It was estimated from calculations made of the number of heat units necessary to heat the buildings, and from a comparison with statistics of the heating of another plant, that 70 tons of coal would be required. Using the same mixture of coal and screenings as were used during the test, the annual cost would be $280.

Lighting.—The lighting load during the all-day test was found to be eight kilowatts, which could be reduced to five kilowatts, by replacing 150 of the carbon-filament lamps by tungsten lamps. There are 300 hours of lighting service in the average factory, and at 10 cents per kilowatt-hour the yearly expense equals $150.

Lamp Renewals.—Fifty lamp renewals would be required on the basis of 900 hours as the average life of the tungsten lamp, which if supplied by the electric light company amounts to $17 annually. This figure does not include breakage, which should be small.

Water.—An annual charge of $10 would cover the cost of water, including the leakage in the heating system and the regular factory service.

Oil and Waste.—The oil and waste requirement for the motors alone would amount to $10, a figure taken from a plant of similar size.

Fixed Charges.—The fixed charges on the electrical equipment were derived as follows:

Cost of motors and accessories:

Two 15-horsepower at $230	$460.00
One 7.5-horsepower at	170.00
One 5-horsepower	111.50
Total	$741.50
Estimated installation cost	200.00
	$941.50
12 per cent of $941.50 =	$113.00

The fixed charges on the heating system were taken as 10 per cent of the value of boiler and piping installed ($1,500) or $150.

The total fixed charges are therefore $263.

TABLE II.—COST OF OPERATION BY EACH SYSTEM.

	Steam	Electric
Coal	$ 989.79	
Water	149.70	
Electricity		$1,407.51
Labor	1,040.00	312.00
Oil and waste	50.00	10.00
Lighting	.....	150.00
Repairs	50.00	.....
Lamp renewals	12.00	17.00
Boiler insurance	15.00	.....
Heating	.....	290.00
Fixed charges	420.00	263.00
	$2,726.49	$2,449.51
Saving by the electric drive		$ 276.98

From the above comparison it appears that there is a saving of $277 per year by the use of the electric drive.

Denver Company Gives Housekeeping Demonstrations.

The Denver Gas & Electric Light Company has arranged a series of lectures on five afternoons each week under the direction of Mrs. Caroline Blair Downing, one of the leading domestic-science teachers of the country. These daily lessons cover every phase of scientific housekeeping, and are given in the Assembly Hall of the Gas and Electric Building. Refreshments are served at each of these lectures, and arrangements have been made to have other prominent women talk on subjects of home interest.

In sending out notices of these lectures and demonstrations, the Company includes a coupon which is good for a substantial rebate in the purchase of any one of 12 groups of apparatus, which are being made special features this spring. Each group includes an electric vacuum cleaner, and each is so chosen that its sale price is just $50. Payment for the equipment may be made upon the monthly plan.

Toronto Company Solicits Chinese Laundries.

There are about 200 Chinese laundries in Toronto, Ont., and most of these are equipped with electric lighting. The Toronto Electric Light Company has instituted a campaign for electric irons among these laundries and has engaged a Chinese solicitor with a wide acquaintance among his countrymen. He is equipped with a sample iron and is provided with circulars printed in Chinese and illustrated, containing directions governing the use of the irons.

United Electric Light & Power Company Employees' Association.

The new assembly rooms of the Employees Association of the United Electric Light & Power Company, New York City, will be opened on the evening of May 22, when the Hon. George B. Cortelyou, president of the Consolidated Gas Company of New York, will speak. Frank W. Smith, vice-president of the United Electric Light & Power Company, will give an illustrated talk covering the history of the company over a period of 32 years.

Akron Company Secures Large Contract.

H. B. Bixler, commercial manager of the Northern Ohio Traction & Light Company, has closed a contract with the B. F. Goodrich Company involving a minimum monthly payment of $1,200.

The active work of this commercial department has resulted in adding over 5,000 kilowatts to the power load of the company since January 1.

Saved by Persistent Work.

The case of Thomas Saxton, a lineman of the Northumberland County Gas & Electric Company, Sunbury, Pa., is a good illustration of the fact that efforts at resuscitation after electric shock should be persisted in until definite results are obtained.

Mr. Saxton came in contact with a 16,000-volt line and fell to the ground. A physician was called but could find no signs of breathing or heart action. Nevertheless, artificial respiration was attempted and the men took turns at this work for more than an hour without any apparent results. Death appeared to have occurred and the muscles seemed to be stiffening.

Not satisfied to abandon his patient, the physician continued his efforts and urged the men to keep on assisting him. Finally there was a flutter of an eyelid and the heart started to beat. In a few minutes Mr. Saxton was breathing normally, and in a short time was able to walk to his residence.

New England Section Convention.

The fifth annual convention of the New England Section of the National Electric Light Association will be held at the Hotel Vermont, Burlington, Vt., September 17, 18 and 19. Arrangements are being made for a very interesting program including the following papers: "Co-operation of Allied Electrical Industries;" "Problems of Central-Station Managers in Cities of Less Than Five Thousand Inhabitants"; "How Present Models of Electric Heating and Cooking Appliances Might Be Improved to Increase the Use of Electricity in the Home"; "Principles Governing Central Stations in Line Extensions and Various Rulings of Commissions Thereon"; "The Central Station's Attitude toward Its Customers."

The committees in charge of the convention arrangements have been appointed; with chairmen as follows:

Hotal and Entertainment Committee, C. C. Wells, Middlebury, Vt.

Publicity and Transportation Committee, E. S. Mansfield, Boston, Mass.

Minimum Reduced in Olympia.

A new tariff on power furnished to small users by the Olympia Light & Power Company has been filed with the state Public Service Commission, and has gone into effect. The tariff does not affect lighting rates. Under the old rate the minimum per month per connected horsepower was $1.00. This is cut to 50 cents per month per connected kilowatt.

Electrical Construction

SOME DIFFICULT CONSTRUCTION IN AN ELECTRIC-PUMPING INSTALLATION.

Changes in a Plant Already in Operation.

It is very frequently the case that it is more difficult to do high-class work in the installation of new apparatus or circuits in a plant where there is apparatus already in operation than it would be to do good work if the entire equipment were to be put in new. This was especially true of the installation of some recent extensions in the electric-pumping station of the city water-supply plant at Rock Island, Ill. A motor-driven pump having a capacity of 2,080 gallons a minute was put in this plant for the purpose of keeping a standpipe filled and of supplying pressure for fire protection to a part of the city.

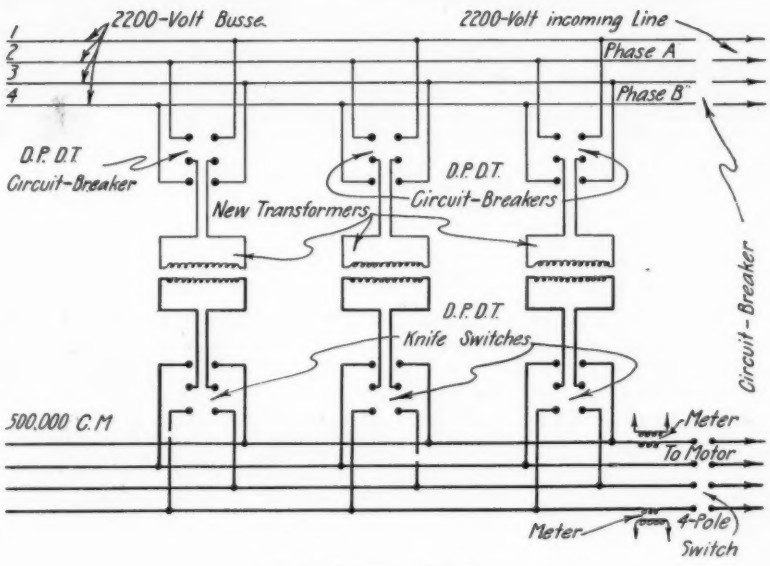


Fig. 2.—Diagram of Wiring.

Aside from the fact that new electrical work had to be fitted to an equipment which had been in service for some time, the installation here involved work of three different kinds. Some 65 per cent of the job was electrical, 20 per cent consisted of putting water piping in, and the rest of it was included in the setting and connecting up of the pumps, etc.

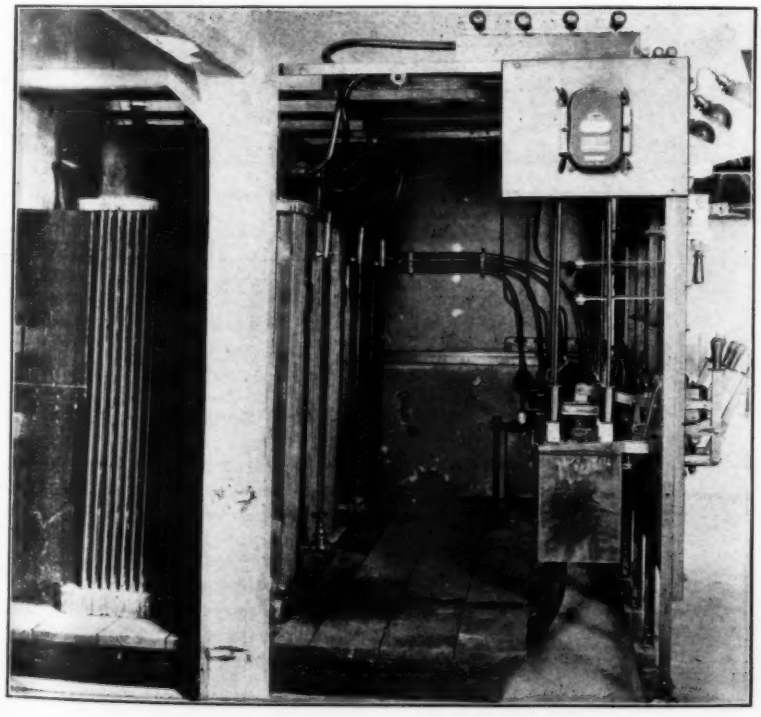


Fig. 1.—Transformers and Rear of Switchboard.

It is interesting to note, in passing, that the city officials had considerable difficulty in finding a contractor who was willing to undertake to do all this work; they wanted to make one company responsible for the entire job. The pump companies and plumbers were disposed to balk at the electrical work, it is said, and the electrical construction men at the piping and pump installation. Finally the services of J. T. Marron, of The Electric Construction and Machinery Company, of Rock Island, were enlisted. His company undertook the work, and, in due season, finished it, having done a good, high-class job on every portion of the installation.

There were already in the substation four transformers which were connected in circuit through a single-panel switchboard, the connection on the primary side being to a four-wire 2,200-volt transmission line, through a four-pole circuit-breaker on the panel just mentioned. On this same panel there were two four-pole knife switches for the control of the secondary circuits of these transformers. The knife switches, and the circuit-breaker as well, were of the single-throw type. The capacity of the larger knife switch

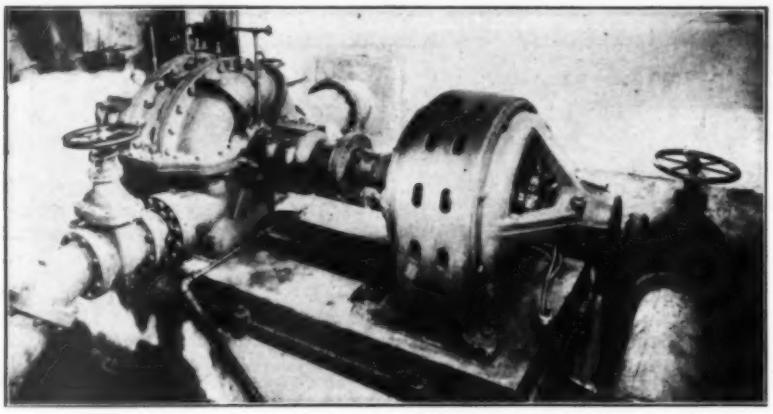


Fig. 3.—Motor and Pump.

was 400 amperes and that of the other one 200.

In the remodeling of the substation three 125-kilowatt transformers were substituted for the four units originally in service and four panels were added to the switchboard. Fig 5 is a good view of the front of the new switchboard. Each of the new panels is 18 inches wide and each one of three of them contains one General Electric Type F Form K-5 double-pole, double throw oil switch, with automatic overload release, and one double-pole, double-throw knife switch having a capacity of 350 amperes. The oil switches are employed to connect the primaries of the transformers to the high-tension busbars, while the knife switches are used to connect with the load busbars on the low-voltage side. Connection between the high-tension busbars and the incoming two-phase circuit is made by means of the oil switch on the switchboard panel originally in the substation.

On one of the four panels that were added to the switchboard there is a 200-ampere four-pole, single-throw, fused knife switch for controlling the circuit to the motor that drives the new pump to which reference has been made. This motor is a 150-horsepower, two-phase, 440-volt machine, of the induction type, having a wound rotor or secondary.

The high-tension busbars are made of No. 0 B. & S. gauge conductors, and each low-tension busbar has a cross-section of 500,000 circular mils. The circuit between the switchboard and the motor consists of four No. 0000 constructors, run in a three-inch conduit—or, to be more exact, this is the circuit from the board to the controlling apparatus used in starting the motor. In Fig. 4 the drum controller and starting resistances are shown. For the proper protection of the motor a 200-ampere oil switch having automatic overload, and inverse time element and no-voltage release is installed near the controlling apparatus.

It will be noted in the accompanying cuts that the transformers are installed behind the switchboard, with ample room between them and the apparatus installed on the back of the board. The frame supporting the switchboard is of the customary angle-iron construction. As a support at the floor for the feet of the frame a piece of channel iron the length of the board is employed.

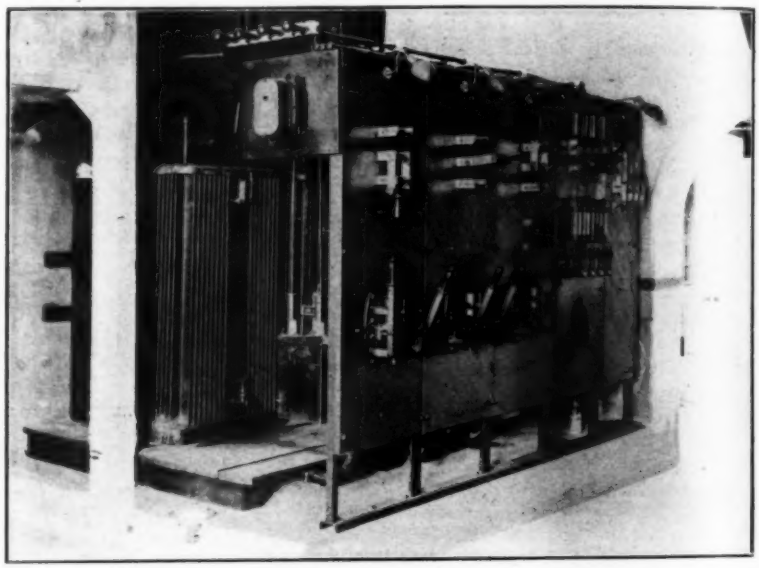


Fig. 5.—View of Front of Switchboard.

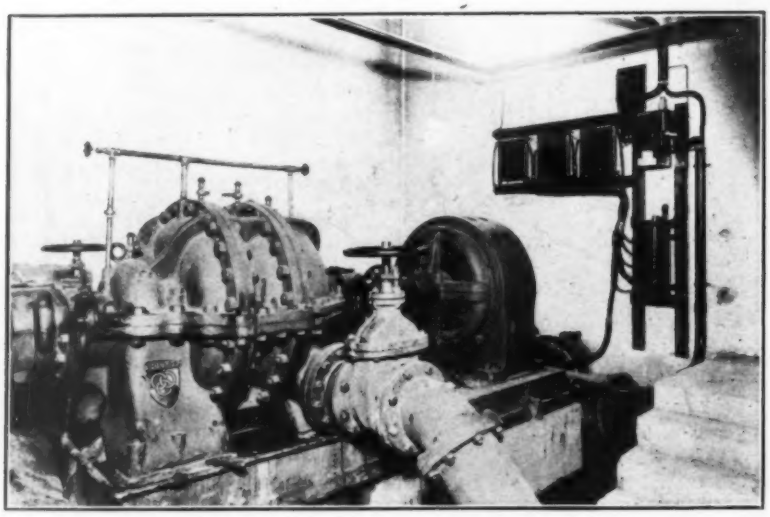


Fig. 4.—Wiring to Controller.

From Fig. 2 one can see just what the switching arrangement is. It will be noted that any two of the three new transformers can be used to supply two-phase power to the low-tension busbars from which the motors are run while the remaining unit is held in reserve to be cut into service in case there should be need for it for any reason. If, for example, a transformer should be burned out, or if it were necessary to refill the oil tank of one of them or make other repairs, the

matter could be taken care of without interfering in any way with the operation of the pumping station. By means of the double-throw oil switches the primary of any unit can be thrown at will upon either phase of the incoming circuit, and the double-throw knife switches make it easy to connect the secondary to whichever phase of the pump circuit it is desired to connect to.

The sort of transformer used in the installation under consideration is so rugged a piece of apparatus that the probability of accidental injury sufficiently serious to put it out of service even temporarily is rather remote. In a water-supply plant, however, freedom from interruption of the service is frequently a matter of vital importance, and hence it was considered good engineering to install three transformers here.

The accompanying photographs were taken a few minutes after the final acceptance test on the completed installation. Two of them show portions of the water piping to the new pump fairly well. The installation of this piping was a particularly difficult job; for there was no place to take measurements from in laying out this part of the work, and the piping had to be cut so that it could be put together and fitted to the old piping without a hitch in the very limited time which could be allowed for this without shutting down the plant. It was necessary to use a transit and make the measurements accordingly. When the piping was put in everything fitted nicely.

While there was a comparatively large amount of work in this installation which was not of an electrical nature at all, this is a kind of job which almost any large electrical contracting firm is liable to be asked to undertake. It is a credit to a firm to be able to handle such work in a satisfactory way when the necessity of undertaking it arises.

Electrical Craftsmen of Chicago Meet.

The Chicago Chapter of Electrical Craftsmen met in the club rooms of the order Tuesday evening, May 13. The special feature of the meeting was an illustrated lecture on telephony by G. W. Cummings, of the Plant Department School of the Chicago Telephone Company. The lecture was fully illustrated.

A MODERN INSTALLATION OF HOSPITAL WIRING.

By Harold L. Alt.

The electrical work in the Hospital for the Ruptured and Crippled in New York City, with which this article is concerned, is of more than ordinary interest, both because of the completeness of the equipment and on account of the high grade of work done in the installation of it. The building is of the most modern fireproof construction. It has its own power plant, located in the basement, the plan of which is shown in Fig. 4.

The power plant consists of three

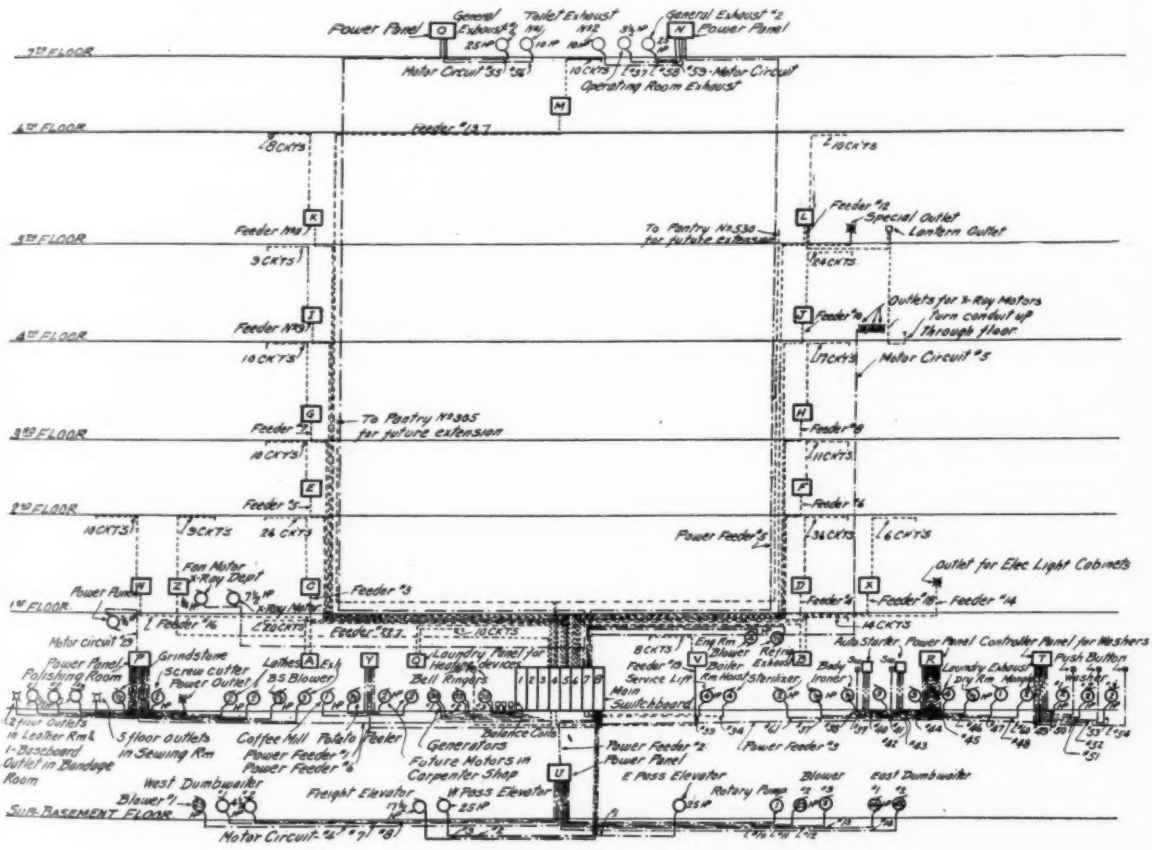


Fig. 1.—Diagram of Risers and Location of Distributing Centers.

75-kilowatt three-wire direct-current generators, which are located in the engine room, supplying a current of 115-230 volts pressure for lighting and 230 volts for power. For all lighting feeders, the three-wire system, and for branch circuits the two-wire system, is used, while on all the power feeders and branch circuits the two-wire system of 230 volts pressure is employed. The engines driving the generators are of the horizontal, single-cylinder, automatic-cut off type, each operating at a speed of approximately 275 revolutions

per minute, and directly connected to compound-wound generators. The generators are over-compounded so as to furnish current at 110-220 volts at no load and 115-230 volts at full load,

LIGHT FEEDERS.
(3 WIRE) TO LIGHT & HEATING PANEL BOARDS

Feeder #	To	Size of Wire	Of Cond.
1	A	5	1½"
2	B	5	1½"
3	C	3	1½"
4	D	3	1½"
5	E	5	1½"
6	F	5	1½"
7	G	5	1½"
8	H	4	1½"
9	I	5	1½"
10	J	3	1½"
11	K	5	1½"
12	L	1	1½"
13	M	3	1½"
14	Light Cabnt.	8	1"
15	Q	3	1½"
16	W	2-0	2"
17	Bell Ringers	14	½"
18	X	3	½"
19	V	10	¾"
20	Pan 305-3rd F.	No Wires	2"
21	Pan 530-5th F.	No Wires	2"
22	Z	8	1"

Fig. 2.—Sizes of Feeders and Conduits.

and are connected so as to operate in multiple, each carrying its proper proportion of the load.

The main switchboard, which is installed in the engine room in the basement, is of marble and consists of eight panels, the marble being of the best quality and highly polished; the slabs are one and a half inches thick with a three-eights-inch bevel on all the face edges. Each panel is made up of three slabs 24 inches wide, the two top sections being 31 inches high and the bottom section 28 inches. The panels are mounted on 2 by 3.25-inch angle-iron framework, with leather washers placed between the marble and the iron. All the busbars and cross connections are

LIGHTING AND HEATING PANEL BOARDS
3 BUS BARS (110-220 Volts)

Panel	Br. Switches	Amp. of Sw.	Amp. Main Sw.
A	24	10	75
B	18	10	50
C	31	30-10 Am. 1-50 Am.	150
D	40	10	100
E	14	10	50
F	14	10	50
G	14	10	50
H	20	10	75
I	14	10	50
J	30	10	100
K	12	10	50
L	18	14-10 Am. 2-50 Am.	50
M	14	10	50
Q	14	12-10 Am. 2-50 Am.	150
V	12	10	50
W	14	25	150
X	10	25	150
Z	12	10	50

Fig. 3.—Data Concerning Panelboard Equipment.

mounted on the back of the panels, there being five busbars which extend across the switchboard as follows: One positive, one negative, one neutral, one positive equalizer and one negative equalizer bar. The switchboard is set four feet out from the wall, and has all the main feeder connections from the generators come up through the floor.

The wiring is run in rigid metallic conduits, a single conduit being provided for each set of conductors for feeders, motor connections and branch circuits, except where two or more branch circuits are run between two outlets or between the panel board and the first outlet, in which cases they are run in one conduit. The conduits throughout are concealed, and no horizontal runs were placed in partitions. On sizes of conduits larger than three-quarter inch standard elbows and offsets are used, but bends were permitted in the pipes of one-half and three-quarter inch sizes. A riser diagram of the scheme of wiring is shown in Fig. 1.

The wires running to outside fixtures and bell push-buttons are lead covered from the building to the outlet, an outlet box with a brass cover being installed at the point where the wires leave the building. No wiring was installed until the plastering in the building was completed and no oil, grease or compound, other than powdered soapstone was used to facilitate the drawing in of the wires. Figs. 2 and 3 give general data relating to the wiring and circuit systems.

The distribution cabinets and panel boards are constructed of three-sixteenth-inch galvanized sheet steel on one by one by one-half-inch angle-iron frames; inside of each one of them is placed a slate box holding the panel board. The space between the outer and inner box is about three inches on all sides. These boxes are set flush with each wall and have neat, No. 10 sheet-steel panel doors and trim. Each cabinet is furnished with a Yale lock, heavy brass hinges and door stop. The panel boards are of black marbelized or enameled slate and have three busbars for lighting panels and two busbars for the power panel connected to the various circuits through double-pole knife switches with molded spool handles and inclosed fuses. All connections are made on the front, the busbars being run up the centre of the slate, with the branch switches and fuse posts for the branch circuits on each side.

Each circuit is numbered, in a cardboard directory with a metal frame and glass face placed upon the inner side of the door which gives a list of the lights, or circuits controlled, by each number and also the size of feeder used.

In general the wall outlets are located with their center line at the following elevations above the finished floor line:

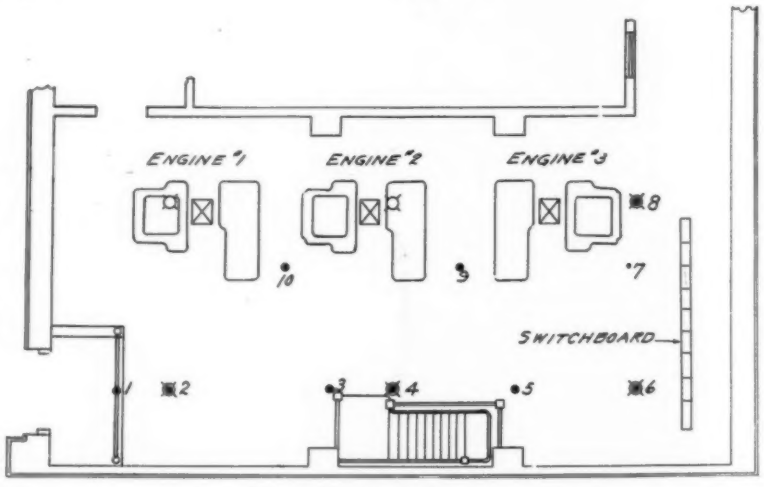


Fig. 4.—Plan of Engine Room.

All bracket outlets, 5 feet, 8 inches.
Switch outlets, 4 feet.
Telephone outlets, 4 feet, 10 inches.
Push-button outlets, 4 feet.

The push-button switches are of the Diamond H two-pole, 10-ampere, flush push-button type, with face plates finished to match the surrounding hardware. Where more than one flush switch occurs in the same location they are arranged in gangs.

The outlets in the iceboxes, of which there are five, have a Russell & Stoll No. 404 watertight fixture, complete with heavy brass guard and globe and are secured to the outlet box with brass machine screws.

Illumination.

Some very interesting tests were recently made in regard to the illumination intensity obtained in various typical rooms in the building. Fig 5 shows a plan of the General Waiting

Room, the location of lights and the test points at which the readings of the foot-candle intensities were taken. There are six fixtures, and each equipped with six 60-watt Mazda lamps burning at top voltage. The room itself has walls and ceilings of a grayish tint with a floor of dark-brown tile, and is about 55 feet and 6 inches long, and 43 feet and 6 inches wide, with a height at the peak of the vaults of 24 feet. Thus there is a floor area of 2,414 square feet, with a total of 2,160 watts, or 0.894 watt per square foot.

The intensities of illumination, in foot-candles, at the points where the tests were made, are as given in Table 1.

TABLE 1.

Station	Reading
1	.68
2	1.26
3	1.35
4	1.37
5	1.27
6	1.18
7	1.29
8	1.32
9	1.16
10	.90
11	.88
12	.78
13	.84
14	1.50

TABLE 2.

Station	Reading
1	.895
2	1.030
3	1.030
4	.895
5	.910
6	1.070
7	1.070
8	.910

Fig. 4 shows the lighting arrangement in the engine room, which has six 100-watt Mazda lamps equipped with opal reflectors as shown in the detail. The walls of this room are light blue on the lower half and white on the upper half, while the floors are of concrete. The room is 46 feet long, and 24 feet wide, which gives it an area of 1,104 square feet. It is lighted with a total of 600 watts, or 0.54 watt per square foot. In making tests on the illumination, the engineer took readings at the points marked in the figure, and obtained the foot-candle values given in Table 3.

TABLE 3.

Station	Reading
1	1.30
2	1.58
3	.90
4	1.40
5	1.88
6	1.41
7	1.15
8	1.34
9	1.09
10	.88

In the laundry the illumination is as high as 3.5 foot-candles on some parts of the floor. The average is approximately two foot-candles.

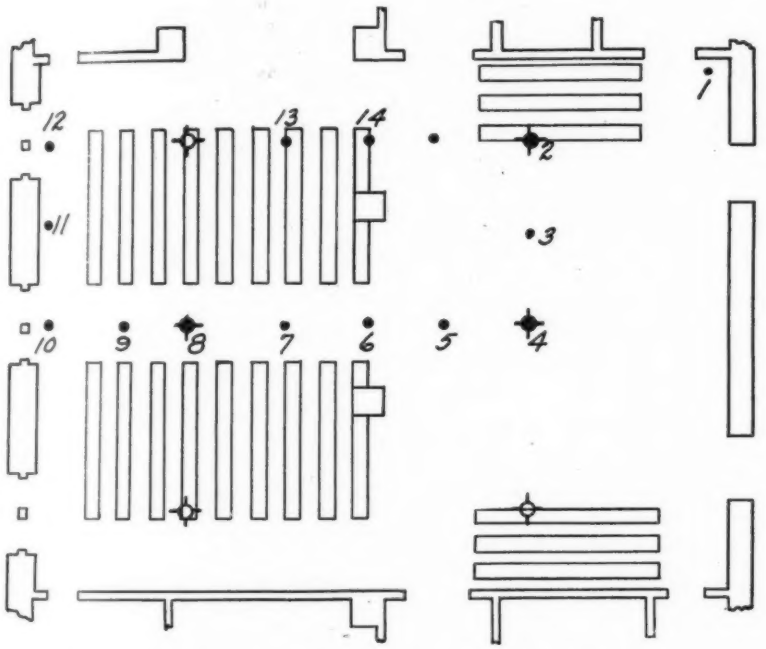


Fig. 5.—Arrangement of Lighting Units in General Waiting Room.

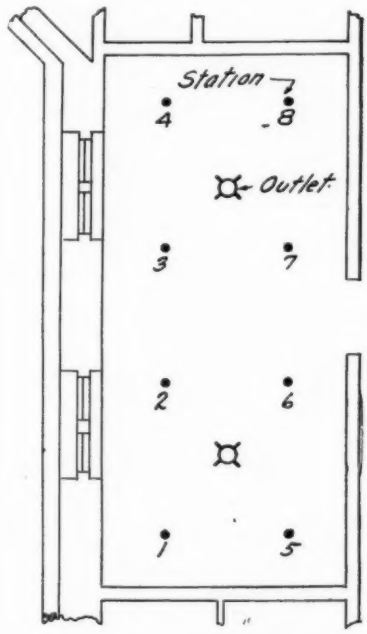


Fig. 6.—Plan of Dining Room.

Fig. 6 gives the layout of the dining room. There are two lighting fixtures each equipped with four 25-watt Mazda lamps, burning at top voltage. This room has cream colored walls, white ceiling, gray terrazzo floors. The floor area is 381 square feet, and the ceiling height 15 feet. Thus the wattage per square foot of floor is 0.522. The intensities of illumination at the points on this floor where readings were taken are shown in Table 2.

Among other rooms in which careful tests were made on the lighting system are the boys' ward, the ward for women, and the laundry. In the first of these rooms, which has a white ceiling, cream colored walls and a yellow mosaic floor, there is a floor area of 1,422 square feet, and the ceiling is 15 feet high. The wattage per square foot is 0.211, which gives an average intensity of illumination of a little more than one foot-candle. Color of floors and walls and height of ceiling are about the same in the ward for women as in the boys' ward. Here there is 0.381 watt per square foot and an average intensity of illumination of about one foot-candle.

Guaranteed Wiring.

The Electrical Contractors' Association in England, according to the (London) *Electrical Times,* is devoting its energies to putting into practicable working shape a scheme lately devised for guaranteeing the work of members of the association. This journal remarks that when the plan is adapted it should do much to remove the prejudice existing in many quarters against the contracting fraternity. There are many contractors, not necessarily members of the Electrical Contractors' Association, whose reputation is a sufficient guarantee of good work, but the capacity of the average wireman is limited, and in every locality there are contractors to whom one would hesitate to entrust wiring work involving any departure from the simplest practice. To invite such workmen to wire for a cooking or heating installation is merely asking for trouble, but if a local firm of unknown competence is a member of the Electrical Contractors' Association no one need hesitate to en-

trust wiring work to it, knowing that in the event of faulty material or workmanship being put in, the contractor, through his Association, can be forced to make it good. It sometimes happens that a small man, faced with the responsibility of making good a faulty installation, will file his petition sooner than face the music; in fact, many a one-man firm has no alternative. The guarantee of the Electrical Contractors' Association will remove this risk, and all that a customer need worry about is to be certain, before placing his order, that the contractor is a member of the Association. The guarantee will improve materially the status of the contracting industry. It will weed out the men of financial instability, the incompetent workman, and that class of contractor too frequently met with, who undercuts all competitors by putting in the lowest grade of material and employing the cheapest labor. It will strengthen the Electrical Contractors' Association and increase largely its membership, since every bona fide contractor would gain in reputation by becoming a member, and—except perhaps in the cases of the largest and best-known firms—suspicion would attach to any contractor not within the fold.

Briefly, the scheme will be confined to interior wiring and to a cash liability of $250 in respect to any one member. The standard of work will be based upon the latest wiring rules. If upon complaint being lodged, it is proved after inspection to be groundless, the party making complaint shall pay the fee for inspection, but should the work turn out to be faulty then the member concerned will be instructed to put matters right; or, failing this, the Association itself will make it good and charge the defaulting member with the cost. If such a member prefers to seek the protection of bankruptcy to meeting his obligations, the Association will know him no more and be none the worse for his absence, although its funds will have to bear whatever cost the bad work has entailed. There are, of course, some difficulties to be overcome before such a scheme can meet every condition and be generally accepted.

No doubt the Association is wise in restricting its liability to $250 per member, for its funds are not inexhaustible; but the amount is a small one, and will not cover many average installations, while quite inadequate as a guarantee for work of any magnitude. No time limit seems to be mentioned. The scheme is intended, no doubt, for the benefit of the smaller ones among the members, large contracts usually being backed by sureties.

Among the Contractors.

C. E. Walters has opened an electrical supply store in the McFarland Building in Fairfield, Ill.

The Farnsworth Electric Company, a well known firm of contractors of Bowling Green, Ky., has the contract for the installation of an up-to-date lighting system in the Cumberland Presbyterian Church in that city.

The electrical contracting business conducted by C. H. Loomis in Akron, O., has recently been organized into the Loomis Electric Company. The company expects shortly to move into new and larger quarters.

Fred L. Kahn, who has been connected with the Blumenthal-Kahn Electric Company, of Baltimore, Md., has severed his connection with that company and taken a position with the National Electric Company, of Baltimore, whose offices and shops are located at 613 East Lombard Street, This company is the local agent for the Elbright System of America, and, as several conventions are to be held in Baltimore in the near future, Mr. Kahn is conducting a very vigorous campaign for his new company. Any time any of his traveling friends visit Baltimore, he will be very glad to receive them at his new location.

Among the important jobs that the firm of F. A. Clegg & Company, of Louisville, Ky., has on hand now are the St. James Catholic church, in the Highlands, Whallen Brothers' store building, in Louisville, the new warehouse of the Standard Sanitary Manufacturing Company, also in Louisville, and the new County School building at Glen View, Ky. The contract first mentioned amounts to about $1,600, and the work will include some unusual features of construction. Indirect lighting will be employed throughout the building. The second job will cost in the neighborhood of $1,000, while the warehouse installation referred to is a $3,000 job. It includes the fixtures as well as the wiring. Between $500 and $600 worth of work will be done in the school building by the firm mentioned, not including the installation of the lighting fixtures.

Robert E. Fay, an electrical contractor of Louisville, Ky., and Miss Lucille Wright, also of that city, were married secretly in Jeffersonville, Ind., which town is known as "the Hoosier Gretna Green," on May 3. The marriage became public a few days later. Mr. Fay is associated in business with his father, John Fay.

L. C. Dye opened a store in Galion, O., on March 15 and will handle a complete line of electrical supplies and fixtures and do a general electrical construction work. The local lighting plant which formerly did wiring and sold supplies has given this up, and Mr. Dye, who was formerly connected with the lighting company, has taken over that end of the business.

The Kittelberger Electric Company, of Akron, O., has been awarded the contract for the electrical installation in the new West High School in that city, the work to be started at once. This company has also just completed the remodeling of all the electrical work on the Polsky Dry Goods Company building and is now finishing the installation of wiring and telephone work in the addition to the Portage Hotel. The Kittleberger Electric Company specializes in telephone installations, etc., which line of work it is particularly well equipped to handle.

With the approval of the Board of Awards, Superintendent of Lights, Robert J. McCuen, of Baltimore, Md., awarded the contract for street illuminations during the convention for the Advertising Clubs and that of the Eagles to Eugene I. Rosenfeld & Company, incorporated. The price quoted was $1,300. There was only one other contractor bidding on the job, whose price was $1,349. The specifications call for a colonnade and courts of honors in several places of the city.

W. B. Smith, of Crestline, O., has recently completed the power plant and motor installation in the works of the Schill Brothers Stove Company, in Crestline. This consists of a 100-kilowatt generator for power and a 10-kilowatt lighting generator, together with about 200 horsepower in motors. Practically all machinery has individual motor drive. Mr. Smith also recently finished the installation of wiring and fixtures in the new Home Store Building in Crestline.

The British Columbia Electrical Inspection Society is the title of an organization which has lately been formed at Vancouver, composed of city and municipal electricians and inspectors, superintendents and other officials of electrical contracting firms, and representatives of power companies and supply houses. The object of the society is the standardization of inspection work, and the co-operation of the various electrical interests. It covers New Westminster, Burnaby, Point Grey, South Vancouver, and North Vancouver, as well as Vancouver.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of lar will be sent to the contributor upon publication.

Tracing Runs of Concealed Conduits.

Not long ago I had occasion to trace out a number of half-inch conduit runs. These runs were from 30 to 150 feet long, and not wishing to put a snake through them I resorted to the following scheme: After using my persuasive powers on my helper, I induced him to fire up his pipe, and then I provided him with a short piece of rubber tubing for a leader. After inserting the tubing in the end of the pipe he blew a mouthful of smoke into the pipe and followed it with a blast of air which drove the smoke through and out at the far end. The ends were marked, and the same performance was repeated on the tablet-box end. The runs were then coupled correctly so that the switches on the board would come in the proper rotation.

J. S. Dodds.

Having Short-Stem Fixtures.

In hanging fixtures with short stems it is often impossible to get the screws into the crowfoot on account of the canopy being in the way, the only way to proceed being to screw the crowfoot to the wall and then screw the stem into the crowfoot, which twists the wires very badly and injures the insulation. To avoid this I bore a hole into the wall beside the wires and allow the fixture wires to pass through the hole while screwing the stem into place. When the stem is screwed into place the wires are easily pulled back with a hook or with long-nosed pliers, and connected in the usual way.

William H. Best.

Simple Device for Bending Conduit.

I have found the scheme illustrated in Fig. 1, very satisfactory for bending rigid metallic conduits. This bending device is made by taking two pieces of two by four-inch timber, 18 inches long, and fastening them to a beam with a couple of half-inch lag screws, six inches long. One end of each piece of timber should be rounded off, as shown in the figure, and the rounded ends are placed facing each other. The upper one is placed two inches above the lower one and the same distance to the right or to the left of it. This gives a free swing in bending the pipe. The beam or other surface to which these blocks are attached should be strong enough, of course, to stand the strain which has to be applied to the conduit.

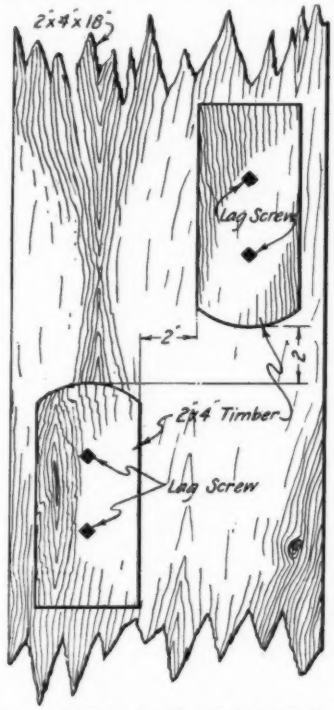


Fig. 1.—Blocks for Bending Conduits.

F. J. Neenan.

When the Switchbox Is Not Flush With the Plaster.

In the issue of May 10 I noticed a kink by Morris Morriarty, in which he shows a way of building out flush switches when the box has been set too far in the wall, his method being to fill a longer machine screw with washers, sometimes a full inch being found necessary. Taking into consideration the great amount of washers needed were many boxes in too far, and the time taken to thread these washers on the screw, and tape them in as he sets forth, the plan strikes me as a time taker. My plan in such places is to just secure a foot or two of one-eighth-inch pipe and cut off small pieces the required length. In this way the switch is built out very quickly.

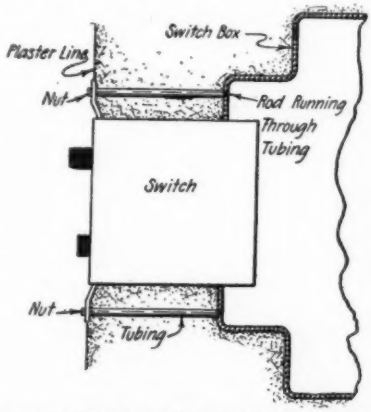


Fig. 2.—Method of Building the Switch Out.

William E. Rhodes.

Another Way to Overcome the Difficulty.

In the issue of April 12 Amherst H. Lamb discusses a method to follow in the installation of flush switches when the boxes for them are set back beyond the finished plaster line. While I consider Mr. Lamb's scheme a very good one, I happen to know that the one-eighth-inch lead pipe or block-tin pipe he uses is very difficult to obtain and is a rather expensive material to use for such a purpose. In place of the lead pipe I have been using quarter-inch circular loom. I find it entirely satisfactory.

A. E. Weinert.

Still Another Way.

I went to finish a job on a concrete house some time ago and found the switchboxes were set from 1.5 to 3 inches back from the plaster surface; so I devised the plan shown in Fig. 2 to build them out. I got some small brass tubing and a piece of threaded rod and some nuts to fit it. I cut the tubing off so it would bring the switch out flush and then cut the threaded rod off about half an inch longer than the tubing, and screwed one end into the box. I then slid the tubing on, and put on a nut to tighten it up.

E. W. Dullea.

[In some of the standard switch boxes on the market the manufacturers make provision for taking care of the above trouble without the use of cylinders of any sort, we believe.—Editor.]

Extension from Outlet Box.

While installing additional wiring for lights and small motors in a new fireproof factory building recently, I found that I would have to use as a feed the nearest ceiling outlet. This being an ordinary 8B conduit box flush with the concrete ceiling, I decided to use a short three-eighths-inch nipple and another box. I screwed the nipple to the fixture stud, and, after removing the center and one other knockout in the bottom of the box, I fastened it up by means of a locknut screwed tightly on the nipple that projected through the center knockout, thus bringing my wires through the other opening. It was then a simple matter to bring a one-half-inch conduit into a convenient side opening.

R. W. Robinson.

Thirty Years Ago.

Electrical News of 1883 as Presented in the "Electrical Review," the Pioneer Electrical Weekly of the United States—Tenth Installment.

(From "Electrical Review," New York, May 24, 1883.)

THE ELECTRICAL THEORY OF THE AURORA BOREALIS.—At the present state of our knowledge of electricity, it is just as certain that the aurora borealis is a display of electrodynamic phenomena, as thunderstorms are a display of electrostatic phenomena. In the latter the electrostatic charges of the clouds break suddenly through the insulating strata of air which separate them one from another and from the earth, and so produce flashes of lightning, which often take place simultaneously between series of clouds extending over a distance of many miles; and as sound is transmitted with a velocity of very nearly one mile in five seconds, and light is transmitted with a velocity practically instantaneous, we must hear all simultaneous discharges successively according to the distance at which they take place, while at the same time their intensity decreases with the distance; this explains the rumbling noise of thunder, which usually begins with a strong explosion, followed by what musicians call "a diminuendo." It is generally known that the distance of a lightning stroke can be estimated by the time elapsing between the seeing of the light and the hearing of the noise, which is about 1,100 feet for every second. In answer to the question where they come from, we say that they have the same origin as the electricity of thunder-clouds, namely, evaporations, mostly of the ocean, which always make the vapor positive electric and the remaining water negative. Taking all facts into consideration—namely, the appearance and action of the aurora—the condition in which we know our atmosphere to be, and the knowledge we now possess of electrical laws, it must be confessed that there is no other theory left which can explain the phenomenon in question with any degree of satisfaction, while the electrical theory is fully sufficient in all respects.

VOLTAIC AND FRICTIONAL ELECTRICITY.—The relation of voltaic electricity is the cause of much trouble among young electricians. Nor is this surprising. According to the laws of energy, chemical action, mechanical work, electricity, heat, light, etc., may be expressed in terms of one another. A passage which has caused no end of perplexity in Tyndall's "Notes on Electrical Phenomena and Theories," may be found on page 15: "The quantity of electricity liberated by the chemical action of a single grain of water on four grains of zinc is equal in quantity to that of a powerful thunderstorm." And again: "The quantity of electricity associated with one-sixtieth of a grain of hydrogen in water, if diffused over a cloud of 3,270 feet above the earth, would exert on an equal quantity of the opposite electricity at the earth's surface an attractive force of 4,996,687 pounds." This extraordinary statement is calculated to puzzle the average electrician, who never takes anything for granted, even if coming from such an authority as Professor Tyndall, or even Faraday. Singularly enough, the sentence quoted from Tyndall originated with Faraday. Faraday was perfectly justified in what he said at a time when the light of his genius was first illuminating the darkness; but it is inexcusable to go on repeating the mere glimpse of a truth he thus perceived, without filling up the outlines since made clear. The same *quantities*, truly, only one is at a potential of 1.5 volts, and the other at several millions. As is well known, people are led into absurdities by thinking about electricity, which is only a word, while the real agent is energy. Electricity is merely the agency for its distribution; just as a pound of water can do little work, but convert it into gases and explode them, and its force is mighty.

BROOKLYN BRIDGE LIGHTING.—Of the different arc systems represented, the Weston system, used by the United States Illuminating Company, and the Brush system, used by the Brush-Swan Company, seem to present greater advantages than the others. While there seems to be little room for choice between the two systems in regard to reliability of the apparatus for continuous use, the Weston system appears, from the facts presented to the committee, superior to the Brush in other respects, and especially in economy of power and in safety. After careful consideration of all the facts presented and consultation with Mr. Martin, engineer of the bridge, it was decided to award the contract to the United States Company.—*Dated April 9, 1883. Signed: J. Adriance Bush, J. S. T. Stranahan, James Howell, Committee.*

A combination having been effected of the Edison and Field interests in electric railroading, there remains only two companies in the United States formed for the purpose of running electric motors for the conveyance of passengers, the other company being the Daft Company, whose manufactory is at Greenville, N. J., and the city office in the Boreel Building. The New York Electric Railroad Company, better known as the Field Company, is soon to fit up a railroad at Menlo Park, N. J. At Greenville the Daft Company has been making experiments for a long time, and is now fitting up street cars with electric motors which are to be placed on the Newark & Bloomfield Horse Car Railroad. Both companies are paying special attention to the street car branch of electric railroading at present, although the Field Company has also the ultimate object of introducing the electric motors on the elevated roads in this city. The system of Mr. Field requires the use of an extra insulated rail which it is proposed to sink in a tube below the level of the street. Along this tube will be a slot so narrow as to prevent carriage wheels passing through. Upon this sunken rail a carriage will travel, to which is attached a steel bar. This bar, passing through the slot, joins the trucks of the street car upon which is placed a dynamo. At Greenville the work of fitting up the cars for the Newark & Bloomfield road is being pushed rapidly. The cars will be run independently, and a single car fitted with the motor will be enabled to draw several others. The current which passes through the rails is of low intensity, and the tracks, which are not insulated, can be handled without danger. Indeed, the current is of such intensity that the ground and dirt offer resistance. Mr. Daft does not claim, however, that no electricity is lost by the ground connection, but, owing to the low current, it is so small as to be hardly appreciable. As regards speed, Mr. Daft thinks 70 miles an hour can be attained by the motors already in use on his track. Experiments with a motor yesterday, which weighed 450 pounds, showed that it pulled steadily over 300 pounds, and at times reached 350 pounds. This force would cause the motor to ascend a grade of 45 degrees. The dynamo used by Mr. Daft is one of his own construction.

J. N. Keller, general superintendent of the Southwestern Telegraph & Telephone Company, is stopping in the city for a

few days at the Hotel Dam. It is rumored that one of the largest transactions ever made in the telephone field is now being manipulated by the Colonel, and it is safe to say that if any sale of the territory he has built up and managed so successfully is made, it will be a large one.

The Northwestern Bell Telephone Company at its annual meeting, held recently, elected George L. Phillips as a director to represent the home interests in the board. The capital stock was also increased to $100,000. The company has put into the Clinton (Iowa) Exchange a new 150-line switchboard. Over 60 towns are now connected.

Among the list of exhibitors at the Chicago Railway Exposition, are the following: American Electric Light Company (Thomson-Houston system of electric lighting), Brush Electric Light Company, Fuller Electrical Company, Electric Railway Signal & Obviating Accident Company, Hall Railway Signal Company, Union Switch & Signal Company, United States Lighting Company, Washburn & Moen Manufacturing Company, Westinghouse Machine Company, Western Electric Company.

The General Committee on Underground Communication, 115 Broadway, New York, contains among others the following gentlemen: Albert B. Chandler, William A. Childs, Grover Cleveland, governor; Leonard E. Curtis, Joseph P. Davis, Sherburne B. Eaton, Franklin Edson, Mayor; Charles R. Flint, Rowland R. Hazard, Edwin Holmes, Clark B. Hotchkiss, Henry Morton, Henry W. Pope, J. Elliott Smith, Elihu Thomson. William C. Behrens is the secretary of the Committee.

If the experiments made by Deprez in Paris recently mean anything at all, they mean that in the future electrical energy is to be generated upon the banks of running streams or waterfalls, and at the coal mines, where fuel is cheap, and then be transmitted by wire to points where power or light or even heat is needed.—[A thirty-year-old prophecy that came true.—EDITOR, ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.]

Few persons are aware of the perils that beset the life of the linemen in the Far West. Desperadoes, idlers and Indians are continually cutting down poles for kindling wood and making a target of the glasses around which the wires are wound. All these must be repaired —hence linemen. Linemen must be intelligent, industrious and sober, and if the reports of their frequent fights with desperadoes may be accepted, they are usually courageous and determined.

The date of filing an application for a patent has been fixed by H. M. Teller, secretary of the Interior, as the date of the invention, in a decision written to the Commissioner of Patents, April 28, 1883.

Some Electrical Patents of Thirty Years Ago.

April 22, 1883:

Electric time register for telephone and telegraph switches, Frank E. Kinsman, New York, N. Y.

Electrical generator and motor, means for operating and regulating electrical generators, Thomas A. Edison, Menlo Park, N. J.

Element for secondary batteries, secondary battery, Charles F. Brush, Cleveland, O.

Method of laying underground electric wires, Charles D. Shrieves and John E. Cook, Philadelphia, Pa.

Push-button and circuit for lighting gas by electricity, Thomas H. Rhodes, Brooklyn, N. Y.

Switchboard for electric circuits, Francis Blake, Weston, Mass.

May 1, 1883:

Armature for dynamo-electric machine, electric arc lamp, electric railway, Leo. Daft, Greenville, N. J.

Electric railway, Walter H. Knight and Edward M. Bentley, Washington, D. C.

Electric heating apparatus, Albert Lieberman and William Robb, Philadelphia, Pa.

Incandescent electric lamp, Philip Diehl, Elizabeth, N. J.

Insulating electrical conductors and a new compound suitable to be used for this and other purposes, Willoughby Smith, Wharf Road, City Road, County of Middlesex, England.

Machine for covering wire for electrical purposes, John J. C. Smith, College Point, N. Y.

Voltaic arc light, Otto A. Moses, New York, N. Y.

(Quotations from ELECTRICAL REVIEW of May 31, 1883, will appear next week.)

Public Service Commissions

CALIFORNIA.

A decision has been rendered by the Railroad Commission granting the application of the Arizona-California-Nevada Telephone Company to sell its plant in Needles to the Needles Gas & Electric Company.

The Citizens Light & Water Company was granted authority to sell its property to the Claremont Domestic Water Company for $70,000.

The Los Angeles Gas & Electric Corporation applied for a certificate of public convenience and necessity to operate under franchise in Eagle Rock and Watts.

A decision was rendered granting authority to the Northern Electric Railway Company to sell a transmission line between Nicolaus, Sutter County, and Riego, Placer County, to the Pacific Gas & Electric Company.

A decision was rendered granting authority to G. K. Estes to sell his telephone plant at Morgan Hill to T. H. Dassel for $2,425.

A supplemental opinion was rendered granting authority to the Oro Electric Corporation to do such work as might be necessary to keep alive its franchise in Stockton.

A supplemental order was rendered granting authority to the Great Western Power Company to use $92,672 of bonds previously authorized for extensions in Napa district, Santa Rosa district, Oakland district, Petaluma district, and the Island district.

MASSACHUSETTS.

A bill which provides for the creation of a new public utilities commission has been passed by the Massachusetts House of Representatives and will probably become a law. The new board is to consist of five members with power to regulate all public-service corporations except lighting companies, which are now, and will still be, under the regulation and supervision of the Gas and Electric Light Commis-

sion. The present Railroad Commission is abolished and its powers, together with supervision of telephone and telegraph companies now exercised by the Highway Commission to a limited degree are given to the new board. By the law railroads are to be allowed to issue bonds to double the amount of the capital stock, whereas at present they are allowed to issue only to the amount of the capital stock. The section relating to electrification of railroads provides that the Commission "shall have power, after hearings, to order from time to time that a railroad company shall operate its lines, of standard gauge, or such parts thereof as the Commission shall prescribe, by electric power instead of by steam power, and its order shall prescribe the time within which the work of electrification shall be done."

The Massachusetts Gas and Electric Light Commission has approved the issue, by the Quincy Electric Light and Power Company, of 500 shares of new capital stock of a par value of $100, at the price of $140 per share. On February 1, 1913, the company had notes outstanding to the amount of $94,588, of which about $70,000 represents expenditures for additions to plant, not otherwise provided for, made since the last approval of stock in 1910. The new stock issue is to be applied to the cancellation of these notes. The Commission has approved the issue, by the Franklin Electric Light Company, of Turners Falls, of 200 shares of new capital stock at $100 per share, the proceeds to pay obligations of the company represented by notes outstanding, and to be applied on the cost of additions to the plant.

NEW JERSEY.

The Board of Public Utility Commissioners has approved an ordinance of the township of Hanover, Morris County, granting a franchise to the Boonton Electric Company.

On the ground of lack of jurisdiction the Board has dismissed a petition filed by the Delaware & Atlantic Telegraph & Telephone Company appealing from an ordinance of the commissioners of Ocean City, requiring the removal of the company's poles, etc., from the public highways and the installation of an underground system for its overhead system.

The petition of the Monmouth Lighting Company for permission to transfer certain shares of its capital stock to the Eastern Utilities Corporation has been dismissed. The law confines a corporation to the purchase of capital stock of a corporation, the property of which is cognate in character and use to the property used in the direct conduct of its own proper business. The Board finds that the Eastern Utilities Corporation is a "holding company" for utility securities, and not in the same class as the Monmouth Lighting Company.

NEW YORK.

The Public Service Commission, Second District, has authorized the Schenectady Illuminating Company to issue its common capital stock to the total par value of $2,000,000. The proceeds are to be used for the purchase of retiring outstanding obligations of the company.

The Commission has authorized the Glen Telephone Company, operating at Johnstown and other places, to issue $50,000 par value of its common capital stock, the proceeds to be used for improvements to its plant.

WISCONSIN.

In one of its most important and far reaching decisions, the Wisconsin Railroad Commission, in the case of Frank Winter vs. the La Crosse Telephone Company and the Wisconsin Telephone Company, has ordered a physical connection between the toll lines of each of the defendant companies with the exchange system of the other. Both companies operate in the city of La Crosse, the former being an independent company owned and controlled by local capital, and the latter a branch of the Bell system. It appears that the general dissatisfaction existing some years ago on account of the rates and practices of the Bell company culminated in the organization of the local company. In consequence of this situation, the local system rapidly increased the number of its subscribers at the expense of the Wisconsin Telephone Company until, at the time of the hearing, the independent company had 4,000 subscribers and the Wisconsin Telephone Company 1,650. Desirous of availing themselves of the superior toll facilities of the Bell company, certain of the subscribers of the independent company petitioned the Commission for a physical connection between the toll lines of one company and the exchange of the other, under the provisions of the physical-connection law passed by the legislature about two years ago.

Apprehending that its local exchange would lose much of its patronage if its extensive toll-line facilities were made available to the subscribers of the competing exchange, the Wisconsin Telephone Company made a very vigorous protest against the granting of the petition. It was contended that the order would have the effect of taking its property without due process of law and without adequate compensation; that irreparable injury would result; and that the efficiency of the service rendered by each exchange would be impaired.

After a careful review of the testimony, the Commission decided that public convenience and necessity demanded the connection sought for; that, owing to the local conditions, the connections can be effected without disturbing the business of either exchange, and at a small cost for installation; that irreparable injury will not result to either owner or user of the facilities of the respondent companies. The order provides that a subscriber of one company desiring toll service over the lines of the other company must pay in addition to the rate charged the patrons of the latter company a reasonable compensation for the additional service, which extra charge will accrue to the company furnishing the toll service. This was held to be a just discrimination between the subscribers of the different exchanges. No rate was prescribed for this service in the order just issued but it is probable that a petition to determine such rates will be presented to the Commission in the near future. The order stipulates that the expense of making the physical connection and the subsequent maintenance be apportioned equally between the two companies.

This case is the first of any magnitude to come before the Commission since the physical-connection law was passed and is more or less of a test case. It is stated that the matter will be carried to the Supreme Court.

The Commission has authorized the People's Water, Light & Power Company of Mellen to issue $35,000 of stock to replace a similar amount illegally issued.

Horse-Car Lines Will Remain in New York.

Governor Sulzer of New York has vetoed the Silverstein bill, relating to the change of motive power on the horse-car lines in New York City, for the reason that he objected to the provision which would allow companies controlling these horse-car lines to issue securities, practically without limitation, for the purpose of providing new equipment. The bill provided for the elimination of all horse-car lines in New York City on January 1, 1914. It was stated that when the Commission was organized, July 1, 1907, there were in operation 16 horse-car lines. At the present time there are six lines which remain wholly operated by horses. Several others have been partly changed to storage-battery operation. Of the six remaining horse-car lines, one will soon be changed to storage-battery operation, and one will probably soon be abandoned.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 140.—Electrical Equipment of Gasoline Automobiles.—Which type of electrical equipment is better for gasoline automobiles, to have the electric starting, lighting and ignition combined in one system, or to have a separate outfit for each purpose? What are the advantages of each plan?—C. B. W., St. Joseph, Mich.

No. 142.—Allowance for Reduced Maximum Demand in Summer.—Recently I read an article explaining a rate system used by a British central station in which the number of hours charged for at the primary rate was less in summer than in winter, so as to compensate for the reduced maximum demand and decreased lighting load in summer and to encourage the use of electricity for cooking. Is this system in use anywhere in this country?—F. D., Racine, Wis.

No. 144.—Questions on Approved Wiring.—(a) Are sign receptacles with contact screws approved to be mounted in cornices for decorative purposes or should only pig-tail receptacles be used, thus avoiding possible grounding? (b) In grouping cables behind switchboards must each conductor have a separate covering of flexible tubing, or is it approved to cover the whole group with one layer of tape? (c) What is the proper size fuse for the neutral of a three-wire, two-phase system? (d) Why do inspectors in different localities make such different rulings, for example in one department No. 8 wire is required to be soldered into lugs, whereas an adjoining department does not require this?—J. G., Newark, N. J.

No. 145.—Interference of Power and Telephone Lines.—It has always been stated that by careful transposition of telephone lines inductive disturbances to them from any other adjoining overhead circuits is prevented. In California much difficulty has been experienced by telephone companies from the neighboring lines of power companies. Is this due to improper transposition or is ordinary transposition ineffective against induction from high-tension lines?—W. M. S., Ogden, Utah.

No. 146.—Ozonator for Direct-Current Circuits.—Are any ozonators built for use on direct-current circuits or is it necessary to connect them to the alternating-current side of a motor-generator or inverted rotary converter?—B. J. L., Cleveland, O.

Answers.

No. 138.—Electric Fly and Rat Traps.—Can a voltage less than 110 be used successfully in electric fly traps? What is the best voltage for electrocuting rats and mice?—M. A., Johnstown, Pa.

A few years ago I worked in a hotel where there were a large number of rats, and having more or less spare time I tried several ways to electrocute them and found out that it is not the voltage that counts so much as it is the amperes that is passed through them. I made up a board with some flat strips of copper about one-half inch apart on it and put some cheese and meat near the center of it. I then connected it to a bank of twelve 110-volt lamps, which gave me about six amperes, and wet the floor all around where the board lay. A short time after I left the board I noticed a peculiar odor around the place and upon investigation found two rats dead, one of them lying across the strips was being roasted, thus causing the odor. I caught quite a few rats with this trap.—E. W. D., Boston, Mass.

Although I have had no direct experiences with fly or insect traps, I recall reading an article in which was described a method used by Messrs. Schildhauer and Tucker in electrically exterminating an army of destructive ants about the garden of the latter's dwelling in the Panama Canal Zone. The voltage was not given, but it was stated that a powerful battery was connected to about 50 yards of closely adjoining wires laid in a smooth path around the garden. As regards the second part of the question, I have built a successful electric rat trap by taking No. 18 bell wire, removing the insulation, sandpapering the wire bright and placing three-foot lengths of it parallel on the floor about three-eights of an inch apart. I used 64 lengths of wire tacked down every foot to prevent short-circuits. At the ends alternate wires were cross connected to opposite sides of a 220-volt circuit in series with one side of which I connected a 32-candlepower, 220-volt lamp. A juicy bait was placed in the center of the wire network. As the feet of the rodents are very tender, this electric trap will get them every time.—W. E. R., Boston, Mass.

No. 143.—Wide Speed Variation of Motor.—Can a simple controller or control system be obtained for a 220-volt 20-horsepower direct-current motor that is required to run for hours at a time at any one of about 12 equally spaced speeds between 250 and 1,800 revolutions per minute? At the lowest of these speeds the load is only four horsepower and at the highest about 25 horsepower.—S. C. C., Richmond, Va.

If you are planning an entirely new installation, involving the purchase of a motor, I would advise you to state your requirements to some reliable electrical manufacturer, who will advise you in regard to equipment. I take it, however, that you have on hand a 20-horsepower, direct-current 220-volt motor, which you wish to change over to variable speed, and the following points may be of interest: The method of control adopted depends on the rated speed of the motor. A constant-speed motor may be run *above* its rated speed by weakening the field by inserting a variable resistance in the shunt-field circuit. To run the motor at a speed *below* its rated speed requires the application of a reduced voltage to the armature, the field excitation remaining constant. One way to accomplish this result is to put a variable resistance in the armature circuit. This method, as distinguished from field control, is wasteful of energy, as considerable energy must be dissipated by the resistance. Moreover, as the current in the armature circuit varies directly as the load, it is evident that the drop in the resistance increases as the load increases. It follows, therefore, that with this method of control the motor speed will vary practically inversely as the load at any given setting of the armature rheostat. But I take it that in this case, the load at any one speed is nearly constant, so that there will probably be little or no trouble on this account. On the other hand, the shunt-field method of control has constant-speed characteristics, the speed remaining practically constant at any given setting of the rheostat, regardless of the load. Another way to secure low voltage for application to the armature is by varying the voltage of the generator supplying the motor, but this would probably be impracticable, unless the motor in question is the only device supplied by the generator. In some cases a separate motor-driven generator is installed to supply current to the motor. This is known as the booster-teaser method of control. If there is a 110-220-volt three-wire system on the premises it would be advisable to use the 110-volt side for the low speeds, and the full 220-volts for the higher speeds, these two voltages being used with a rheostat for the intermediate speeds. To recapitulate, if the rated speed of the motor is between 250 and 1,800 revolutions per minute, variations in speed between 250 and the rated speed are obtained by varying the voltage applied to the armature, the shunt-field excitation remaining constant. Variations in speed between the rated speed and 1,800 are obtained by weakening the shunt-field excitation. If the rated speed is such that the field will have to be weakened excessively to secure the required speed of 1,800, commutator trouble may result, due to excessive armature reaction on the weak field, unless the motor is provided with commutating poles, or a cumulative-compound winding.—V. A. R., Ansonia, Conn.

LETTERS TO THE EDITOR.

Arrangement of Cutout Cabinets.

To the Editor:

I note that in an article in your issue of May 10, by E. S. Rowe, on metering small office buildings where the expense of installing regular metering tablets is prohibitive, there is described a system we have been using for the last two years, except that we use three-wire cutouts and run one side of the circuit, fused, of course, straight through all the cutouts in the neutral connection. Then one other side is run through a cutout and back through the other side. In this way one can meter one or more rooms by simply running each room on a circuit and then continuing the bus from the meter to the cutout to as many cutouts as are desired on one meter. We also hinge the whole front of the panel so that this swings out to allow various changes in the meter connections; we find this makes a very satisfactory way to meter office buildings in smaller towns, where there are not over eight or ten offices to take care of.

We space the cutouts about one and one-fourth inches apart so that the bus wires can be readily carried to the branch-circuit cutouts from the meters directly opposite the cutout, as required by the rules, so that no wiring is run around the cutouts, all this being done in the wiring.

We find your articles on practical work very interesting and have found many helpful suggestions in them.

E. M. RAETZ.

Rochester, Minn., May 12, 1913.

Litigation Over Letters Patent—the Wireless Telegraph Suits of Fessenden and Marconi.

To the Editor:

There has been a new set of rules provided which control the District Court of the United States in trials of the validity and infringement of letters patent. Prior to February 1, it took two or three years to obtain a decision and then the appeal would take more time. Under the new rules it is possible to get a decision in a few months. In one of my recent cases the complaint was filed in July, part of the testimony was taken under the old rules, part of the testimony and trial was under the new rules; the decision was made in April last, the defendant was enjoined, and the case is now on appeal. Much of this saving in time is gained by taking testimony in open court; it is no longer possible to examine an expert witness for months in a lawyer's office; nor can a lawyer take testimony in several cases at once, providing inexperienced monitors to watch the proceedings in each of several cases. The Court in every case will shorten the proceeding by limiting the scope of the questions, ruling out irrelevent matter, the heretofore recorded verbal clashes between counsel, and will in every possible way limit the inquiries to the essential question. In a recent case in the Southern District of New York, involving the Fessenden patents, the Court stated emphatically that he would look at any and all publications, such as books, encyclopedias, technical serial publications, which treated of the subject and inform himself as to the state of the art, making his decision not alone on the evidence introduced by respective counsel, and he further questioned counsel on both sides very much after the manner familiar to practitioners in examining expert witnesses; it seemed that counsel, to render satisfactory service, should necessarily be qualified as experts in the particular art under examination. In Professor Fessenden's case the trial took two weeks, counsel asked for one day to sum up and the Court said they might take two days, evidently providing for the questioning and "cross-examination" to which he subjected the counsel during the summing up. This practice is founded on the English practice in patent cases, which seems extremely meritorious, as anyone will appreciate if they read the decision of Justice Parker in the Marconi case which was published April 26, 1911, Volume 28, Reports of Patent Cases, page 181.

It may interest your readers to know that this same case on Marconi's United States patent is pending and will probably soon be heard here in New York.

W. B. VANSIZE.

New York, N. Y., May 14, 1913.

Fees for the Registration of Electricians.

To the Editor:

Relative to the editorial on fees for the registration of electricians which appeared in your issue of May 10, let me say that I am in favor of any reasonable and just measure for preventing men not regularly engaged in the business of electrical contracting from taking contracts to install electrical work. A practice which I think especially needs to be discouraged is the one on the part of electricians on the payroll of contractors taking work to be done evenings or at other times outside of regular working hours. Starting in this way, men are sometimes induced to become contractors who have neither the funds nor the experience needed to carry on even a small business in a legitimate way. Moreover, the practice is unfair to the contractor who employs the electrician. A man who works for himself evenings and holidays is usually not in condition to do the sort of work for his employer that the latter has a right to insist upon, to say nothing of the temptation of the electrician who installs work on his own account to appropriate his employer's tools and materials to his own use. Not long ago a man whom we had just employed stated that he had been doing jobs of wiring on his own account during odd hours and that he had a quantity of material which had been left over from these jobs on hand. To induce him to discontinue this practice we bought his material. Afterwards we heard from a reliable source that the material had been stolen.

The electrical contractor should handle such cases in a severe manner. Of course, it is understood that the employer should have a clear understanding with every man he hires as to such practices and the attendant result upon discovery.

ARTHUR WAGNER.

Chicago, Ill., May 17, 1913.

A Temporary Water Power Station.

In connection with the construction on the White Salmon River, Wash., 75 miles east of Portland, of the 20,000-horepower hydroelectric development, it was found necessary by the Stone & Webster Engineering Corporation to establish a temporary hydraulic plant for the purpose of furnishing power for carrying on the work incident to the building of the large plant.

A power flume 9 feet 3 inches wide, built of wood, diverts water from the stream right through the new 125-foot dam now in process of construction, carrying it to a point a few hundred feet below the dam, where the small wooden power house has been established, operating under a 13-foot head of water. The prime mover is a 54-inch turbine built by S. Morgan Smith Company, York, Pa., capable of delivering at 13-foot head a maximum of 300 horsepower. This is direct-connected to a generator rated at 150 kilowatts and 440 volts. The electric power is used for various purposes on the immediate work, including quarrying on top of the hill 400 feet above the dam, operating concrete mixers, lighting, drilling, etc. It is also used at a point more than a mile down the river where the power house is being built, to which point it is transmitted at 6,600 volts.

This development, which is to be operated by the Northwestern Electric Company, of Portland, Ore., will have a head of 175 feet and an impounded volume of 40,000,000 cubic feet of water. This water is gathered from a drainage area of 350 square miles.

Production of the Diamond in the Electric Furnace.

Small crystals of carbon, which in fact are real diamonds, have been produced by a Paris engineer, E. de Boismenu, by an electric-furnace method. The process is based upon the electrolysis of a bath of melted calcium carbide by the use of direct current, the result being a decomposition of the carbide, and there is formed at the negative pole a black and spongy mass of carbon containing minute crystals, which are found to be crystals of pure carbon, and consequently diamonds. During his first experiments, which were made with a small and imperfect plant, he succeeded in obtaining crystals 2.5 millimeters long, but this does not appear by any means to be the limit and it is believed that much larger crystals can be obtained.

While occupying a position as head of an electrolytic plant in France for the commercial production of carbide, M. de Boismenu was led to observe the effect of electrolysis of carbide by direct current and concluded that it might be possible to produce crystals of carbon in this way. Later on, he installed a small experimental plant in the suburbs of Paris, and after a few preliminary trials he succeeded in confirming his views and producing crystals of carbon.

He employs a small electric furnace of refractory brick, having the bottom packed with a powdered lime and carbon mixture which serves as a trough to hold the melted carbide. Within the trough a pair of round carbon electrodes 6 to 7 inches in diameter are placed, and the furnace is then charged with fragments of calcium carbide and covered over with a mixture of lime and carbon. The carbons are drawn apart to a maximum of 10 inches, using a current of 700 to 800 amperes. The longest heat he used was 12 hours. At the end of the test, it is found that the ends of the electrodes are surrounded by a mass which adheres to them and is composed on the positive side and in the middle of calcium carbide, while at the negative pole is a black and coke-like mass of carbonaceous material which contains graphite and also numerous minute crystals of carbon. These crystals he had analyzed by M. Lacroix, professor of mineralogy at the Natural History Museum and M. Maquenne, professor of applied chemistry at the College de France, both of whom pronounced the specimens to be crystallized carbon, having answered all the tests for the diamond. Jewellers to whom he submitted specimens pronounced them at once to be diamonds.

There is a close connection between the length of the operation and the size of the crystals, and it is a well known fact that crystals will grow in size according to the length of time employed in their formation. It was only local conditions of current supply which prevented him from running the furnace more than 12 hours at a time. He observed that the crystals appeared to increase in size at the rate of 0.2 millimeter per hour, and is led to suppose that by keeping up a heat for three days, for instance, he will be able to form crystals 15 millimeters long and weighing 60 carats.

It will be remembered that the late Prof. Moissan produced microscopic diamonds by the electric furnace, but his method was extremely difficult and had more of a scientific than practical value, and besides there was little hope of producing larger specimens. On the contrary, the method used by M. de Boismenu is a simple one to operate by a skilled worker, and there appears to be no doubt that much larger crystals can be obtained in the future.

Remarkable Automobile Tractor Test.

As a substitute for horse and mule teams for transferring loaded freight cars from one station to another, the Pennsylvania Railroad has built an electric tractor—a giant electric automobile which will do the work of 20 mules. To determine the strength of the tractor the company arranged a tug-of-war between it and an ordinary steam locomotive.

Two freight cars were put between the tractor and the locomotive; the power of the latter was first turned on, and after the two cars and the tractor had been pushed a short distance the electric current was applied very gradually. The power in the locomotive and the tractor was increased until each exerted its full strength. The motor developed the stronger power, pushing the two cars and the steam locomotive to such an extent that the wheels of the latter slipped on the track.

The tractor is equipped with two motors, each having a capacity of 20-horsepower; it weighs 28,850 pounds, each wheel alone weighing about a ton. The wheels are 60 inches in diameter and are fitted with hard rubber tires, similar to those used on automobile trucks. The truck straddles the railroad tracks, which, in city streets, are laid flush with the pavement.

As showing the capacity of the tractor, it can start a draft of six loaded 50-ton freight cars on the mountain grade of the Pennsylvania Railroad—that part of the railroad from Altoona, Pa., to the crest of the Allegheny Mountains.

Electrical Supply Jobbers' Convention.

The spring convention of the Electrical Supply Jobbers' Association will be held at the Congress Hotel, Chicago, Ill., May 26, 27 and 28. There will be the usual routine business meetings each morning and afternoon, and on the morning of the third day there will be an open session when J. M. Wakeman, general manager of the Society for Electrical Development, will deliver an address respecting the accomplishments and objects of the Society.

T. C. Ringgold, chairman of the entertainment committee of the local jobbers and manufacturers, announces that if the weather and other conditions permit, the visiting ladies will be given an automobile ride through the parks and boulevards of Chicago, with in all probability luncheon and cards at the South Shore Country Club. This will be for the second day of the meeting.

The golf committee, composed of W. W. Low, M. B. Austin and W. H. Colman, will arrange for golf at the local clubs if there is a demand for this pastime.

A committee composed of N. G. Harvey, Frank A. Ketcham and W. W. Low will be in charge of the arrangements for the ladies on Tuesday.

Annual Meeting of American Institute of Electrical Engineers.

On Tuesday evening of this week, May 20, the American Institute of Electrical Engineers held its annual meeting in New York City. The report of the Board of Directors was presented as was also the report of the Committee of Tellers on the election of officers for the ensuing year. C. O. Mailloux was elected president.

The technical session was held under the auspices of the Railway Committee, two papers being presented and discussed. A full report of the meeting will be found in next week's issue.

More Flaming-Arc Lamps for Chicago.

The Chicago City Council has authorized the purchase of 15,000 additional flaming-carbon-arc lamps, which will make the total lamps of this type in use in the city for street lighting over 23,000.

Copper Exports.

Exports of copper for April totaled 33,024 tons as compared with 23,341 tons during same month last year.

It was reported on May 10 that wireless communication had been established between the stations at Sayville, L. I., and Nauen, Germany. The distance between these stations is 4,000 miles.

SWITCHBOARD EQUIPMENT FOR THE PARALLEL OPERATION OF ALTERNATORS.[1]

By Arthur H. Ford.

The switchboard of an electric power plant being the point from which the generating plant and the distributing system are controlled, it should be supplied with such instruments as will indicate the electrical condition of the entire system at all times and such switches and auxiliary devices as are necessary for changing the number of generators in service and for keeping the potential constant at the feeding points. Furthermore, it should have no unnecessary instruments or apparatus on it; as these tend to confuse the operator, particularly at times of emergency.

Switchboard equipment has been a matter of slow growth and as a result we find many switchboards equipped with only those instruments and auxiliary devices which were required for the control of direct-current generators or alternating-current generators not working in parallel; and which therefore are inadequately and improperly equipped for the control of generators operating in parallel. We also find a few switchboards with all the necessary equipment and considerable that is unnecessary. The writer, having noticed the lack of proper equipment on many switchboards, had the switchboard of the service plant of the State University of Iowa supplied with such equipment as one finds in only the best power plants of the country. As a result of the experience gained in operating this switchboard and such tests as could be made without interfering with the maintenance of regular service, the method of operation advocated in this paper was put into service some four years ago and has been in use continuously ever since. During the last year a switchboard, similarly equipped, has been installed in the Dynamo Laboratory of the State University of Iowa so as to make possible the study of the problems of parallel operation under conditions which could be completely under the control of the operator; as to load as well as to generator operation. It may be noted in passing, that this is the only switchboard of this kind in the country, used exclusively for purposes of experiment.

The upper part of this switchboard, which is for the control of two two-phase generators and two feeders, is show in Fig. 1. Each generator panel has two ammeters at the top, with a voltmeter between them. The row of instruments below consists of an indicating wattmeter at the left, a power-factor meter next and a field ammeter at the right. Next below these are a voltmeter receptacle, a field-rheostat handle and a field switch. The handle immediately below the rheostat handle is the governor control switch, which in this case, controls the driving torque of the motor which is used in place of the engine or water wheel. The generator switch, not shown in the picture, is just below the governor control switch and the synchroscope receptacle just to the left. The panel between the generator panels is a tie panel and supports, in addition to the switch, the synchroscope, frequency meter and watt-hour meter. This switchboard is described in detail because it will be used to show the various changes in instrument indications which accompany changes in driving torque and field excitation.

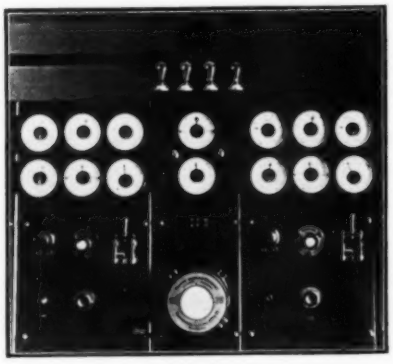


Fig. 1.—Switchboard.

The general conditions to be fulfilled are, that, the load being balanced between the phases and consisting of incandesent lamps, frequency and busbar potential are kept constant, no matter what adjustments are made.

(*a*) The generators are adjusted to share the load equally, both as to current and power, and each have a power-factor of substantially unity as shown in Table I. This is also shown in Fig. 2; where $O\ E_t$ is the busbar potential, $O\ L_1$ and $O\ E_2$ the generator electromotive forces, obtained by adding the impedance drops $E_t\ E_1$ and $E_t\ E_2$ to the busbar potential. The field currents are roughly proportional to $O\ E_1$ and $O\ E_2$, the exact relations being determined by reference to the no-load magnetization characteristics

TABLE I.—INSTRUMENT READINGS WHEN TWO GENERATORS ARE OPERATED IN PARALLEL.

	E	I_1	I_2	Power	Power Factor	Field current
	Generator No. 1.					
(*a*)	110	20.0	19.5	4.25	—.995	2.15
(*b*)	109	22.2	21.8	4.25	+.94	1.90
(*c*)	109	25.0	24.5	5.3	+.995	2.15
	Generator No. 2.					
(*a*)	110	20.0	20.5	4.3	—.995	1.80
(*b*)	113	21.7	21.7	4.35	—.80	2.10
(*c*)	109	15.0	15.5	3.20	—.92	1.80

of the machines. $O\ I_1$ and $O\ I_2$ are the armature currents, the power outputs of the two generators being proportional to their projections on $O\ E_t$.

(*b*) On increasing the field current of generator No. 2 and decreasing that of generator No. 1 so as to keep the busbar potential constant, the conditions shown in Fig. 3 are produced.

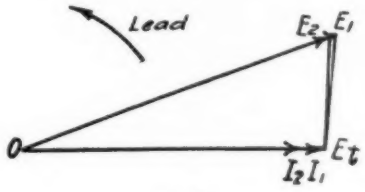


Fig. 2.

The armature current of each machine has increased slightly, the power output of each has remained constant, the power-factor of generator No. 1 has decreased markedly, with the current becoming leading and that of generator No 2 has decreased markedly with the current becoming lagging. The vector diagram shows that the quantity in which the greatest change has taken place is the phase angle of the armature current for each machine.

(*c*) On bringing the field currents back to their original values and increasing the driving torque of generator No. 1 and decreasing that of generator No. 2 so as to keep the frequency constant, the conditions shown in Fig. 4 are brought about. (See Table I.) The current and power of generator No. 1 have both increased in about the same proportion, the current leading the busbar potential slightly. The reverse changes have taken place in the current and power of generator No. 2. An inspection of the vector diagram shows that the change in the phase angle of the impedance

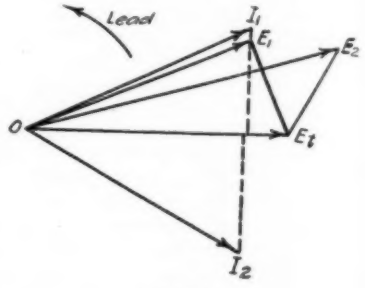


Fig. 3.

drops $E_t\ E_1$ and $E_t\ E_2$ very nearly compensates for the change in their magnitudes and therefore little change takes place in the busbar potential when shifting the load from one generator to the other by operating the governor control switch. The minimum current will flow in each generator when its current is in phase with the

1 A paper presented at the meeting of the Iowa Electrical Association at Waterloo, Iowa, April 24, 1913.

busbar potential, as indicated by the power-factor meter, and therefore the field rheostats should be adjusted, when changing the load from one generator to the other, so as to maintain this condition as well as constant potential.

While these tests were made with a lamp load, similar conditions will prevail when the load is inductive, the

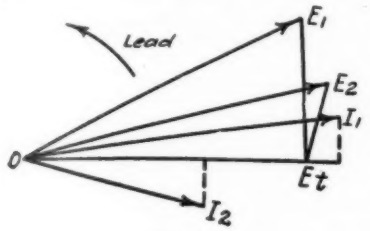


Fig. 4.

most notable difference being that the power-factors of the machines can never be made unity but will have as their maximum values the power-factor of the load.

The proper switchboard equipment for the parallel operation of alternators is determined from the above experiments and general considerations as follows. The receiving devices connected to a distributing system require a constant potential and a constant frequency; therefore a busbar voltmeter and a frequency-meter are necessary. These must be visible when operating the field rheostat and governor control switch of any generator and therefore should be placed on a swing bracket at one end of the switchboard; the voltmeter being above the frequency-meter because the rheostat handle, which is operated to produce a change in the potential, is above the

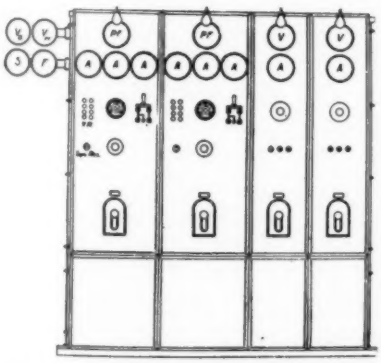


Fig. 5.—Design of Three-Phase Switchboard.

governor control switch, which is operated to produce a change in frequency, or shift the load from one generator to another. The operation of parallelling a generator requires the use of a machine voltmeter and a synchroscope; which are also placed on the swing bracket with the voltmeter above, for the same reasons that the busbar voltmeter and frequency meter are located there with the voltmeter above. Each generator panel is equipped with a power-factor meter; for the power-factor shows the greatest variation of any of the quantities when the field excitation is varied. This meter is located on a line with the voltmeters so as to make it easy to glance from one to the other, it being easier to move the eyes horizontally than at an angle. Next under the power-factor meter are three ammeters for a three-phase board, or two for a two-phase board, one for each phase, mounted on a line with the frequency-meter, for their indications must be noted in connection with that of the frequency-meter when operating the governor control switch to shift the load. Ammeters are used for indicating the load on the generators, rather than wattmeters, for they are necessary in order to determine when a generator is loaded to its current capacity and they show the division of power between generators operating at the same power-factor as well as wattmeters, and therefore the latter are unnecessary. The other devices required are a pilot lamp across the generator field to show when current is being supplied to it; a generator voltmeter switch; a field switch; a synchroscope receptacle and a main switch. An inspection of Fig. 5, which shows a three-phase board of this design, will give a clear idea of the relative arrangement of instruments and operating devices, each being in two rows so that the operation of a device in the upper row will influence an instrument in the upper row and similarly for devices in the lower rows.

A switchboard equipped in this manner, at the suggestion of the writer, has been in successful operation for over a year. The method of operation is as follows. A generator is put into service in the ordinary manner, except that full control of its speed is assumed by the man at the switchboard, who varies the speed by the use of the governor control switch. The load is shifted from one machine to another by the use of the same switch, taking care to keep the frequency constant. The power-factors of the generators are kept the same by adjusting the field rheostats, care being taken to keep the busbar potential constant.

General Electric Directors.

At the annual meeting of the General Electric Company at Schenectady, N. Y., on May 13, the following were elected to fill vacancies in the board of directors: M. F. Westover, Schenectady, and I. S. Keeler and C. P. Moore, of New York. The directors renamed are Gordon Abbott, Oliver Ames, C. A. Coffin, George P. Gardner, Henry L. Higginson, Robert Treat Paine, 2d, Marsden J. Perry, E. W. Rice, Jr., S. L. Schoonmaker, Charles Steele, Philip Stockton and B. E. Sunny.

The Electric Carbon Arc at Low Pressures.

The recent investigation of the carbon arc at pressures less than one atmosphere by M. La Rosa has brought to light some interesting facts. The lamp consisted essentially of two inclined carbon rods inclosed in a large glass bell-jar. The distance between the poles was controlled by an automatic regulator. When the air pressure in the jar was decreased to a few centimeters of mercury the arc showed no remarkable changes either electrically or optically. The current remained practically constant, the voltage across the arc decreased slightly, and the length of the arc increased, thus showing that the current passed more readily as the pressure was lowered. On the other hand, when the pressure was reduced to a few millimeters the arc gradually changed its essential form and appearance. The core, formed by the anode and cathode flames, and the mantle no longer possessed sharply defined boundaries. The mantle became almost invisible, while the core altered to a diffuse luminous region in which various bright and dark parts could be seen. On the whole, the arc at low pressure possessed the well-known characteristics of the discharges in vacuum tubes.

Coal Mining in the United States for 1909.

Statistics of coal mining in the United States for 1909 are given in a bulletin soon to be issued by Director Durand, of the Bureau of the Census. The total production of coal in the United States in 1909, in round numbers, was 460,000,000 tons. The total tonnage of bituminous coal was 379,000,000 and the total tonnage of anthracite 81,000,000.

The total value of all products of the industry was $577,143,000, and the total net expenses of coal mining and coke manufacture at the mines were $530,359,000, of which about four-fifths was for wages and salaries. The number of wage earners employed at mines with complete reports was 743,000.

The average value per ton has increased in every region except the Rocky Mountain, Northern Great Plains, and Pacific Coast. For the entire country the increase for bituminous coal was from $0.99 in 1889 to $1.07 in 1909.

Plans of Society for Electrical Development.

Owing to the fact that the program of the National Electric Light Association contemplates the opening of its convention on the evening of June 2, it has been arranged as being more convenient to the members of both associations to hold the annual meeting of the Society for Electrical Development, at 11:00 a. m. on June 2, at the Hotel Sherman, instead of May 31, as announced last week. The meeting on May 13 in New York was adjourned to reconvene in Chicago, so as to make it possible for members of the National Electrical Light Association and the Society for Electrical Development to attend both meetings, without the necessity of making two trips for the purpose.

At the meeting of the Board of Directors on May 13, it was recommended strongly to the members of the society that the design and slogan selected for the Society be used on the stationery and in all trade-paper, magazine and newspaper advertising; also on all house organs issued by the members and in every other way possible. The slogan is "Do It Electrically," and the design is illustrated herewith.

It was decided that the great mass of material collected in the various papers and discussions at the conference held March 4 and 5 would be bound together in an inexpensive volume and distributed on request.

A special committee was appointed to prepare suggestions for an amendment to the constitution covering the classification of members. It appears that there has been some objection on the part of some of the electrical interests to subscribing on the basis of their gross annual sales through the belief that it would be necessary to divulge what their annual sales would be, and for this reason while the suggestion was that the proportions would remain the same, that some method be worked out whereby it would not be necessary to state absolutely what the volume was in each case.

The Board approved the report of the Committee on Plans, which made a definite concrete plan for the active work of the Society. The general aims of the Society already have the approval of the Public Policy Committee and Executive Committee of the National Electric Light Association, of the National Electrical Supply Jobbers' Association, the National Electrical Contractors' Association and a number of the representative electrical manufacturers. The detail plans are as follows:

The directors appointed from the field at large a committee composed of men especially expert in the different phases of effort which the Society will carry out. The plans as outlined here have had the approval of this committee.

Plans.

Advertising.—A national advertising campaign in general magazines, trade and class papers, etc., this campaign to be of a broad educational nature designed to educate the consuming and non-consuming public to the many advantages of electricity for light, heat, power and other useful purposes, including special arguments for adequate wiring circuits, outlets, etc.

A comprehensive follow-up system in connection with the above so that each individual member will receive a copy or notification of every inquiry coming from his locality and the manufacturing members will receive direct copy or notification of every inquiry made relating to the apparatus which they manufacture.

Stimulating and assisting in the publication of educational literature of various kinds to architects, builders, other trades and public, including publications of a similar character to those now being issued by the Commercial Section of the National Electric Light Association, Illuminating Engineering Society and by other outside agencies, and where it is not possible to stimulate the publication of booklets of this character, organization of this department to prepare those which seem necessary or advisable.

Emblem of the Society for Electrical Development.

Booklets of an educational nature to be used as far as possible in answering direct inquiries coming from national advertising and other sources and also to be supplied in quantities at a minimum cost to members for local distribution through co-operation with above agencies.

Collecting of material from central stations, manufacturers, advertising agencies, etc., and preparation of additional material if advisable, so that specific information can be furnished relative to advertising copy and cuts for newspaper advertising, booklets, folders, envelope stuffers, circular letters, etc., to assist members in planning and carrying out advertising campaigns. This can be accomplished at low cost by close co-operation with members, advertising agencies, etc.

Advising and arranging for and furnishing material for national publicity and advertising weeks (or months) on certain phases of electricity.

Accumulating and furnishing to members data regarding development and sales campaigns to increase the use of electric signs, improve and develop street lighting, power, heating, etc.

Maintaining of information bureau for statistics and data of various kinds relating to commercial subjects—merchandising, selling campaigns, advertising, etc.

Publicity.—The accumulating and disseminating of data, photographs, cuts, etc., for use in newspapers, general magazines, trade and class papers, as well as to free-lance writers, furnishing data, articles and stories of all character to all classes of publications, including architectural, building, farm publications, women's magazines, etc.

Furnishing articles and information to the trade press as well as to the bulletins of the national societies.

Furnishing of news material to co-operative newspaper pages where requested.

Furnishing of a news service to members to be used locally in newspapers.

Arranging with newspapers throughout the country and with magazines, newspaper syndicates, trade press, special writers, etc., for stories, articles and information.

Preparing and disseminating of articles and information which will assist in the unification of water-power laws, electrical ordinances, sign and wiring regulations and the like.

Preventing as far as possible the publication of untrue articles or stories tending to injure the business or mislead the public, and to correct any misinformation published.

Field and General Effort.—Co-operation with Jovian Order and other electrical societies and organizations as a national proposition, and locally among the various branches and local leagues to obtain co-operation in the industry and in the carrying out of the Society's work.

Suggesting various ways and means for co-operation among the different electrical interests in the electrical and allied industries, and stimulating as far as possible more harmonious relations and wider co-operation among the various interests engaged and either by stimulating local endeavor or by carrying out work direct, assist in various lines of local development, etc.

Suggesting ways and means of co-

operation locally in the various cities with the Chambers of Commerce, Boards of Trade, etc., for the development of the electrical business.

Addresses by trained men before various electrical societies and before architectural, building trades and various other industries to increase co-operation and acquaint them with the greater value of electricity for light, heat, power and all other purposes.

Working nationally and locally for better co-operation with Underwriters' Laboratories throughout the electrical business, to improve conditions generally, a special committee to be appointed for this purpose.

Stimulating and assisting in organization of co-operative community advertising.

Arranging locally for equipping of various industrial plants for electricity to the fullest point of saturation.

Exchanging information regarding plants so equipped and arranging for publicity throughout the industry and to the public regarding such plants.

Assisting in plans for bureau for lectures and demonstrations in various cities.

Assisting general co-operative plans for moving-picture exhibitions, exchanging of films, etc., perhaps in connection with traveling electrical show.

Assisting by suggestion in ways and means for developing day load, electricity on the farm, household appliances, power, etc.

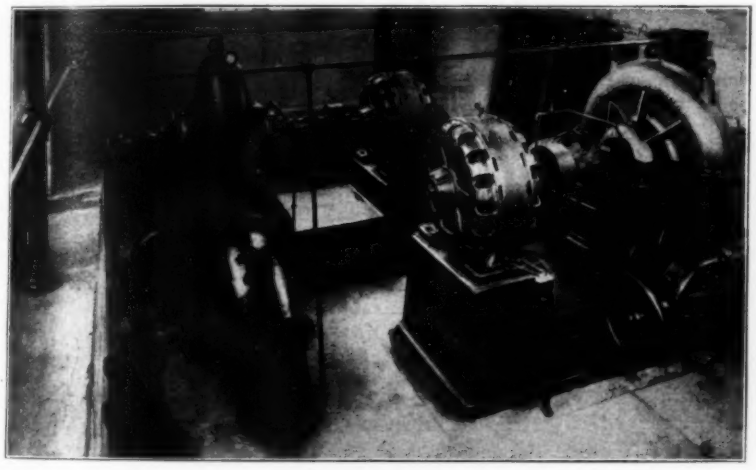
Electrocution in Pennsylvania.

By a vote of 159 to 2 the House of Representatives of Pennsylvania passed the Hess bill for the use of the electric chair in executions in that state. The measure is pending in the Senate and it is almost certain to pass. The measure also provides means for prohibiting the public from witnessing executions.

Grand Rapids Sewage Pumping.

The Grand River, which flows through the city of Grand Rapids, Mich., has caused considerable expense to the city by overflowing during flood periods, and backing up through the sewers. The river has but a small drop between Grand Rapids and Lake Michigan and the current is therefore not excessive even in the flood stages, thus preventing the rapid running off of the drainage water. In summer, the stream can be waded without difficulty, but when the spring thaws come the stream often rises 15 to 20 feet in the course of a few hours.

The sewer system of the city discharges into this river from four principal sewers. At flood stages, these sewers are considerably below the water level, hence the river backs up through them, flooding the basements of buildings in the lower portion of the city, which includes the principal business section. So much heavy damage has been done in the past that steps had to be taken to prevent the possibility of the water reaching the basements.



Pumping Station at Grand Rapids.

The river has been dredged through its course in the city and the banks lined through practically the entire distance, by reinforced concrete walls averaging 20 feet in height, which prevents the stream from overflowing. The water is prevented from backing up by valves in the sewers by which the discharge opening is entirely closed. To force the sewage into the river against the higher head during flood stages large centrifugal pumps are installed at the mouth of each sewer and the piping arranged so that with the normal water level the sewage discharges directly into the river without the use of the pumps; but in flood periods the discharge valve is closed and the sewage discharges into a sump pit from which it is pumped over the well into the river. Three stations have been built and the equipment has already been used a number of times. In one of the stations two large pumping units are installed, in the other two there are three units, while the fourth when completed will have four large units.

The pumps and the equipment at stations are as shown in the table.

All the pumps except those used for priming are direct-connected to their driving motors. The priming pumps are belted to their driving motors. The motors and electrical equipment were supplied by the Westinghouse Electric & Manufacturing Company.

The power is supplied from the circuits of the Grand Rapids & Muskegon Power Company, so that attendance in the stations is required only when there is danger of a flood. Then the attendant goes to the station, throws in the main-line switch and closes the discharge valve. When the sewage level reaches a predetermined point, the attendant starts the pumps and runs them until the river falls so that the sewage will discharge by gravity. When the flood is over, the attendant opens the discharge valves and shuts the motors down entirely and, after what slight cleaning might be needed, the station is closed until the next flood.

Although one man at each station could readily perform all the work required, two men are always on duty during floods, to prevent any possibility of trouble in case of accident to an attendant.

Pumps					Motors		
Number	Size, Inches	Type	Normal Head in Feet	Capacity Normal	power Horse-	R.P.M. Speed	Connection
			Canal Street Sewer Station				
2	18	Centrifugal	3.1	12,000 g. p. m.	30	340	Direct
1	..	Vacuum	....	12 cu. ft.	2.5	550	Belted
			West Side Ditch Station				
2	24	Centrifugal	6.6	17,000 g. p. m.	60	340	Direct
1	12	Centrifugal	6.8	4,300 g. p. m.	30	340	Direct
1	..	Vacuum	....	12 cu. ft.	2.5	550	Belted
			Front Street Sewer Station				
2	24	Centrifugal	10.2	17,000 g. p. m.	60	340	Direct
1	12	Centrifugal	10.2	4,200 g. p. m.	75	345	Direct
1	..	Vacuum	....	12 cu. ft.	2.5	550	Belted
			East Side Trunk Sewer Station not installed)				
4	40	Centrifugal	6.7	47,000 g. p. m.	175	575	Direct
1	..	Vacuum	....	36 cu. ft.	6	560	Belted

Poulsen System to Be Adopted by United States Navy Department.

It is understood that the Navy Department has reached a decision on the bids for erecting wireless telegraph stations to link up Washington, D. C., with the stations at Hawaii, Guam, the Philippines and the Panama Canal Zone. After a series of stringent tests it is understood that the choice has fallen upon the improved Poulsen system as developed by the Federal Telegraph Company of California.

THE SALES ORGANIZATION AND TRADE-PAPER ADVERTISING.

By William G. Campbell.

Of singular importance among the causes for the rapid growth of trade-paper advertising is the enthusiasm aroused in the organization of the advertiser. Martial music on the field of battle, pomp and oratory at a public meeting, in fact, all forms of ceremonial propaganda would be energy wasted did not the all important element to every undertaking, enthusiasm, result.

In all fields of endeavor the primary prerequisite to success is confidence in the project. The ability or inability of the principals to radiate their belief in the concern and its products, so that it permeates the entire organization, is invariably the difference between success and failure. There can hardly be any question about the intensity with which the proprietors do of necessity regard their own proposition; they are, however, endeavoring to win others. To do this, mediums are employed, and these are the sales force and advertising, both closely correlated.

Every successful executive realizes the necessity of utilizing in each employee the better self—and we do have two separate and distinct personalities. There is the one which hesitates, languishes, sometimes even despairs, and which exemplifies "Can I?"; and there is the other that has no time for dilatory reflection, but with ever increasing ardor goes in with the "I will" spirit and wins. Those who have had actual experience in the field and association with "the man away from home" know what this "Can I?" condition is. A rainy day—which should be the best work day because every one is in—invariably depresses the salesman. On such a day the road man often kills time in the office of a friendly customer; he is beyond reach of the boss's supposedly stimulating "ginger" letter. Something, apparently from the outside, must hit him—and it does. His host, a subscriber and reader of the up-to-date trade paper, remarks: "That is a fine 'ad' your people have in this week's issue. Whoever gets up their copy is on the job." Right here your traveling man is interested. He reads the lively "pulling-power" copy of "this issue's" advertisement, takes his host's order, apologizes for his hasty departure and forgetting the rain, goes out after more business. His bigger and better self—the something in him that gets his employer what he is paying for—is working. What the mind in this high-efficiency state will do for both man and employer is impossible to calculate, but it is safe to say the physical action will equal the mental pace. Further, this intensity is transmitted to each successive customer, who, in a lesser degree, imparts it to others. Working this way the close of the day will not require a diversion in the form of dissipation, but rather relaxation during which he will be much satisfied with both himself and the house. The letter home accompanying orders and reports will bear ample witness to the satisfactory order of affairs in the man's keeping.

Sales agents are rapidly adjusting themselves to their modern sphere of usefulness. Their vocation is to represent the principal so that his products will be properly distributed through legitimate channels. The old-school manufacturer's agent, competing with the jobber, has long since disappeared. It is equally difficult for high-class manufacturers and representatives to discover each other. In casting about for good lines to handle the trade-paper advertisement space is the directory consulted. The "ad" most impressively gotten up will attract the best man. There will be no low-class applicants, as these unfortunate persons will be overawed. The established branch offices, when properly advertised, will be constantly on the lookout for, what is now in a sense, their "ad." It is sad to contemplate what their thoughts will be should the "ad" be missing or compressed into an insignificant corner.

The local or city men differ from the others in that they, being at home, receive publications regularly at their permanent addresses. Their interest is precisely similar to the road man, but by reason of being in close fellowship with the office they are subject to the prevailing general influence. It is necessary at this point to broaden the scope of the subject and to include to a certain extent the entire concern, clerical and executive. As a matter of fact, the shipping department should be placed strictly subordinate to and affiliated with the sales. The efficient, accurate handling of the goods is the finishing touch to the order in question, and, without doubt, the great persuader when the placing of repeat business comes up. It is a time-honored statement that "a satisfied customer is the best advertisement," and perfectly true, provided the fact be advertised.

It is interesting to note what happens to the trade paper on arriving at the main office. The mail clerk will on opening the cover instantly turn to see what the "ad" looks like; it will be promptly shown the office boy for his admiration; then the stenographer, and so on until finally the august principal beholds it. Here it will be regarded with a touch of what might be described as honest vanity; it is but natural, too, that distinctive public announcement of one's wares should awaken just pride. From the high boss down to the humblest errand boy, every one will be happy trying to excel their previous best, the entire day will be one of utility, no moment being wasted.

Should occasion seem to favor it, the advertisement might be circulated to every workman or at least be made a feature of the next salesmen's meeting. The manufacturers of all widely advertised commodities in addressing their selling organizations make capital of the amount of advertising they are carrying on. Observe what an opportunity has been overlooked in many instances where the full possibilities of the medium in question have been neglected. Checking up display for the purpose of paying the bill will not be merely a formality with the auditor; he, too, will be interested. An establishment alive to every opportunity will have constant incidents, small in themselves, tending to keep all on the only side of the street open to them, the sunny side. No attempt will be made to enumerate these happenings from day to day; it is, however, worthy of note that the next day's eye opener will be the cheerful letter arriving from the man who, enthused by the trade-paper advertisement, worked in the rain.

Power House Breakdown in London.

An unusual breakdown occurred at the power house of the London County Council Tramways in London, England, on April 14. The trouble began in a reciprocating steam engine where the cotter holding the piston rod to the crosshead became loose. After being jolted from its position, the piston was blown through the cylinder cover, which left the generator without any driving power. This generator became short-circuited and the surge thus set up started a short-circuit under the switchboard. An arc then occurred on a direct-current panel alongside the control desk, thus causing a fire which drove the operator from his position. It was necessary to shut down the generators, after which the switchboard fire was extinguished by means of sand. Although the system is provided with automatic disconnecting switches and similar devices, they did not operate in this case so as to protect the rest of the system when the first generator got into difficulties.

Both houses of the Oklahoma Legislature have adopted a joint resolution submitting a proposed constitutional amendment requiring railroads, telephone and telegraph companies and other transportation or transmission companies to domesticate in Oklahoma and submit to the general supervision and restrictions of the Corporation Commission before they shall be entitled to the right of eminent domain.

Efficiency Test of a Mill Supplied by Vertical Boilers.

In the following paragraphs are given an outline of a test performed upon a 1,500-kilowatt, vertical-type Curtis turbo-alternator in a cotton-mill plant, supplied with steam from a battery of ten Manning vertical boilers. The test was run through two five-hour periods in a single day, the boiler data being obtained through a total run of 11 hours and including the standby fuel consumption during the noon lay-off of the plant. The turbine was designed for an output of 2,000 kilowatts, but the generator was rated at 1,500 kilowatts, being equipped with a motor-driven fan for forced ventilation. During the test the fan was not operated, as the object was to check the turbine performance with its guarantee at rated load. The exhaust was delivered into a barometric jet condenser outside the turbine room, injection water being obtained by pumping from a canal close at hand, the pump being driven by a variable-speed direct-current motor controlled from a rheostat located on the turbine platform. It was not desired to determine the steam or coal consumption of the turbine with auxiliaries in the test, and as the boilers were equipped with under-feed stokers operated by steam, the latter were supplied from independent boilers so that the steam actually used by the turbine could be determined by weighing the feed water. The boilers were rated at 120 myriawatts each and the operating steam pressure was 175 pounds. The turbine guarantee was based upon the steam consumption per kilowatt-hour delivered at the switchboard.

In the preparations for the test, two iron tanks of 1,600-pound capacity were supported on platform scales, these emptying into a third tank from which the boiler feed was drawn, the make-up water being taken from the mill reservoir. The weighing tanks were emptied about once in three minutes into the storage tank. Fifteen-minute readings were taken of the temperature of feed water, steam pressure, flue-gas temperature, outside-air and boiler-room temperatures, and hourly readings were made of the barometer, injection water and hot-well temperatures. The mechanical control valves on the turbine were examined and the number open and operating recorded every 15 minutes. The coal was tested in a Mahler bomb calorimeter and power-factor readings were taken hourly. The principal switchboard instruments were also read every quarter-hour.

The results of the two five-hour turbine tests show that the load remained practically constant at 1,050 kilowatts during the forenoon and increased to about 12 per cent overload in the afternoon, at which load the steam consumption is less than when running on full load. The

RESULTS OF THE TWO FIVE-HOUR TURBINE TESTS.

	7 a.m.-12 m.	1 p.m.-6 p.m.
Boiler pressure, absolute.	189.9	186
Degrees superheat	9.9	24.7
Vacuum in condenser, in inches.....	27.39	27.06
Total kilowatt-hour output of turbine.....	5,250.5	8,358
Coal fired, pounds.....	12,087	19,722
Water required by boilers, pounds.....	116,713	172,581
Coal per kilowatt-hour, in pounds	2.3	2.36
Steam per kilowatt-hour, pounds	22.2	20.6
Average exhaust pressure in turbine base.....	26.9	26.48
Average power required to excite generator field, kilowatts.....		
Average load in kilowatts during test	1,050	1,671

turbine fulfilled its guarantee of running on 20 pounds of steam per kilowatt-hour at 175 pounds pressure, 125 degrees superheat and 28 inches vacuum for, upon analysis and correction of the data, it was figured that under these conditions, the turbine would call for 18.2 pounds of steam per kilowatt-hour. The values obtained in the test were larger intrinsically on account of poor vacuum and low superheat. The principal factors and data in the accompanying boiler test were:

Duration of test, 11 hours.
Grate surface, 198 square feet.
Total water heating surface, 9,101 square feet.
Total superheating surface, 3,174 square feet.
Boiler pressure, absolute, 187 pounds.
Draft, 1.98 inches.
Temperature outside air, 50 degrees.
Temperature boiler room, 80.6 degrees.
Temperature steam, 393 degrees.
Temperature flue gases, 496 degrees.
Temperature feed water, 114 degrees.
Coal consumed, 33,919 pounds.
Moisture in coal, 1.39 per cent.
Water evaporated per pound of dry coal at actual temperature and pressure, 9.03 pounds.
Equivalent water evaporated per pound of combustible, 11.03 pounds.
Dry coal burned per square foot of grate surface per hour, 15.37 pounds.
Water evaporated from and at 212 degrees per square foot of heating surface per hour, 2.60 pounds.
British thermal units per pound of coal, 13,690.
Heat lost in flue gases per pound of coal, 2,264 British thermal units.
Air per pound dry coal, 22 pounds.
Volume of CO_2 in flue gas, 9.84 per cent.
Oxygen, 9.57 per cent.

The Utility of the Rural Telephone.

The farmer who has a telephone is always within talking distance of his neighbors five, ten, fifteen or more miles away. The answering voice when he calls is as good as a hearty handshake. It brings with it a sense of nearness, which may prove to be a real help in an emergency. An unusual illustration of this will be found in the following article from a Pennsylvania daily paper.

WILLIAMSPORT, Pa., March 24.—"Your house is afire," was the surprising message that came over the telephone to Miss Lydia Sheadle at her home in Nippenose Valley this morning. At the same instant she heard the crackling of flames on the second floor, and with her sister and mother had barely time to gather up a few belongings and escape before the roof fell in.

The nearest neighbor, a half-mile away, had seen flames shooting from the roof. He notified the telephone operator, who called the Sheadle home and summoned every farmer in the district to help fight the blaze. Other buildings on the farm were saved.

Not only does the rural telephone prove a valuable aid in an emergency, as it did in this case, but in the everyday life of the farmer as well. When he needs something from town it is not necessary to hitch Old Dobbin to the buggy and drive to town perhaps only to find out that the store is all out of what he came for. He can step to his telephone, call up the store and order his supplies. The farmer saves time, his horse and his wagon. A minute at the telephone suffices!

The telephone's commercial value to the farmer is greatly increased by the help it gives him in selling operations. Before he takes his produce to the markets, a few minutes spent at the telephone will give him a report on the price situation. He can then take his produce to where he can get the best price. Better still, he can ofttimes even close his sales over the telephone after getting his market report, without first having to drive into town.

When the crops are growing or ready for gathering, the telephone may be the means of saving a whole season's work from destruction by enabling the farmer to telephone to the post office every morning to obtain a reliable government weather report. If frost or storms are predicted, he can take measures of protection in time to avoid a partial or even a total loss.

Then there is the social side of farm life. In ten minutes the telephone will get in touch with all of the near neighbors and in almost less time than it takes to tell it, arrangements are completed for a husking bee, a barn dance, or any other form of amusement. By offering in this way what are considered the advantages of city life the telephone has become a great factor in the continually spreading back-to-the-farm movement. It helps to keep the young man on the farm.

As an indication of the extent of rural telephone development in the United States, the Western Electric Company reports that during 1912 over 100.000 rural telephones were sold by it to farmers' mutual companies, or direct to farmers themselves, making a total of over 500,000 telephones in four years. There are now over two million farmers using the telephone.

Vienna's Street Railways.

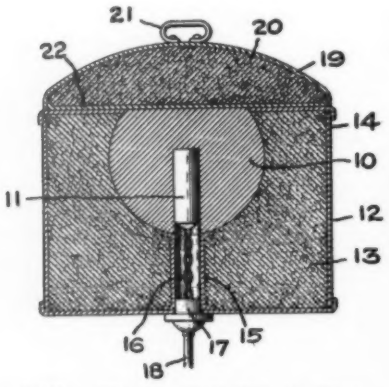
In Vienna, Austria, there are 644 miles of electric railways. Of this 44 miles are operated with single-phase current, and the remainder with direct current. Two of the direct-current lines use 100 volts.

New Electrical and Mechanical Appliances

Stanley Electric Heat-Storage Stove.

For many years William Stanley, of Great Barrington, Mass., one of the oldest and best known electrical inventors of this country, has been working on the production of electric heating and cooking devices embodying the principle of heat storage so as to make their power demand or watt consumption small. In the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of October 28, 1911, was given an illustrated description of the Stanley electric heat-storage range. The same principle in greatly simplified form is used in a new Stanley stove that was patented on May 6, 1913. This patent has been assigned by Mr. Stanley to the General Electric Company.

As shown in the accompanying illustration, the central feature of the new stove is the heat-storage mass *10*, which is preferably a spherical block of cast iron with the upper part cut off to a plane surface. Imbedded in the lower central portion is a heating unit *11*, such as the Vogel cartridge type. The connecting wires pass through an insulating tube *15* to the terminal or plug *17*. Between the storage block and the outer metallic casing *14* is a filling of heat-insulating material *13*, such as powdered silica, infusorial earth, asbestos, etc. Surrounding the upper surface of the storage block *10*, which is the active heating surface of the stove, is a metallic ring in the same plane and extending to the side walls of the casing. This ring is made of a special metal or alloy having high thermal resistance or relative poor conductivity for heat. The lower surface *22* of the cover is a smooth plate of the same non-conducting metal or alloy, whereas the upper surface *19* of the cover may be of the same metal as the casing *14*. The cover is filled with a heat-insulating material *20* similar to *13*, that used in the main body of the stove. The handle *21* permits the cover to be easily removed.

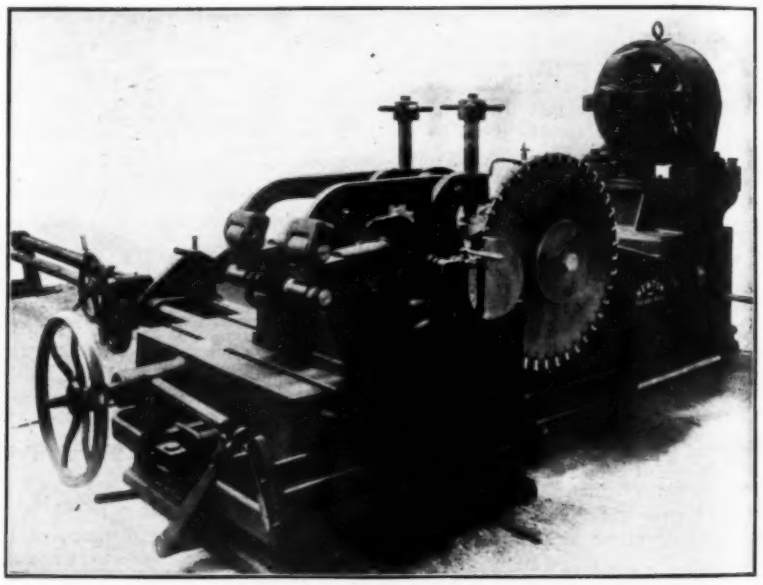


Section Through Heat-Storage Stove.

Current may be applied to the heating element at a low rate continuously or during periods when the load on the central station is low, so as to secure low off-peak rates. The heat is stored in the central block, which has high heat-storage capacity, and since this is very effectively heat-insulated scarcely any heat is lost or conducted to the casing. The temperature of the block steadily rises until the stove is to be used. The cover is then removed and any ordinary cooking vessel with smooth, conducting bottom may be set on the exposed, highly heated surface of the block, which then acts as an accelerated disk stove and rapidly transfers stored heat to the vessel. When the contents have been sufficiently boiled or cooked, the vessel is removed, the cover replaced on the stove, and further heat allowed to accumulate. When used intermittently in this way, the stove is always ready for immediate service. The current required is relatively very small compared to the amperage needed for ordinary disk stoves or other heating devices which take a heavy current for the short time they are in use. Special utensils and dishes are not needed.

A Fast Motor-Driven Cold-Metal Sawing Machine.

The demand for a cold-metal sawing machine capable of handling the smallest structural shapes and commercial bars in a rapid and efficient manner has been met by a machine developed in the plant of the Newton Machine Tool Works, Philadelphia. Pa. Time and speed studies indicate the economical rate of the machine to be about 4.5 minutes for 10-inch-diameter, 35 to 40-carbon steel rounds, while in actual commercial work it averages 23 pieces of 7.25-inch rounds in one hour and 56 minutes, including locating, setting, removing, and cutting, or five minutes for each piece. The saw blade, which is 40 inches in diameter, has a capacity for solids up to and including 12-inch squares and 12-inch-diameter rounds.



High-Speed Cold-Metal Saw.

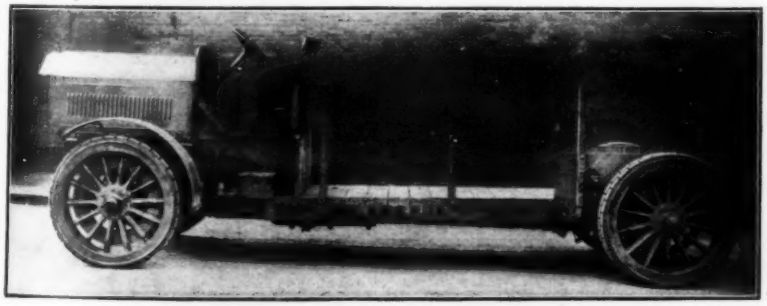
The machine occupies a floor space of 15 feet, 6 inches by 5 feet with an extension of 14 feet 6 inches for the stock trolley. The work table is of massive construction, 42 inches long by 46 inches wide, a casting integral with the base and fitted with T slots at right angles to resist the stress of the cut. There are six changes of gear feed provided, reversing fast power traverse, in addition to hand adjustment. All driving gears are of steel; feed is positive and the fast traverse is friction-clutched. An adjustable, automatic, and positive safety release to the feed and fast traverse are provided.

The machine is driven by an adjustable-speed Westinghouse motor, with a speed range of 550 to 1,100 revolution per minute. The motor is mounted on a substantial bracket of exceptional height to give a long belt center. With this motor cutting speeds of 38.5 to 77 feet per minute can be obtained.

Successful Test of Gasoline-Electric Steam Fire Engine.

The first motorized steam fire engine to be seen in Providence, R. I., made its appearace on the streets there recently. A test was made of its speed and efficiency and was witnessed by Chief Weeks and several other officials of the Providence Fire Department and they were very much pleased with the demonstration, as the machine worked very satisfactory in every way.

It is the Hoadley front-drive tractor with gasoline-electric equipment attached to a first-size Amoskeag steam fire engine, both of which are built at the Corliss Works of the American & British Manufacturing Company,

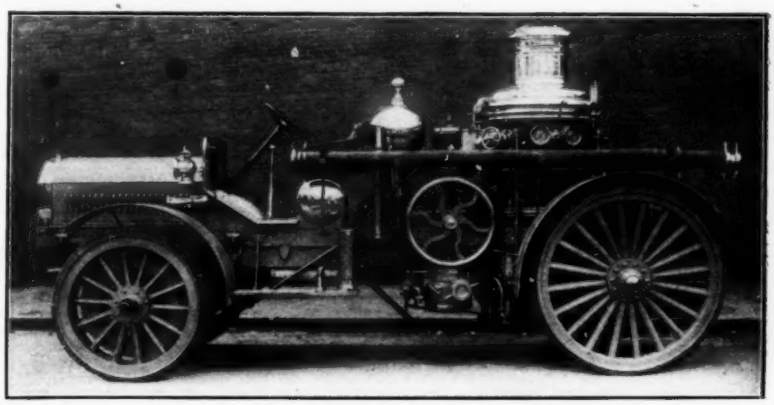


Hoadley Front-Drive Tractor Attached to Truck.

Providence, R. I. This front-drive tractor can be attached to any piece of fire apparatus or trucks of any description, practically without taking the apparatus out of commission, which is a point of great importance.

It is claimed that in this gasoline-electric machine, the gas engine is not subject to the shocks and strain that must be met in a mechanical transmission outfit. It has also been demonstrated that a gas-electric fire engine can be stopped on a 15-per-cent grade by simply reducing the speed of the engine and started again by slowly increasing its speed until the voltage is raised sufficiently to overcome gravity and road friction. It is also claimed that a gas-electric tractor for a fire apparatus is handled in narrow streets and congested districts easily, the two-wheel front drive practically eliminating skidding. It occupies less space than required for horse and wagon apparatus and by eliminating chains, sprockets, sliding and reverse gears, it reduces the upkeep to a minimum. Rough or snow-covered pavements, heavy grades and low temperatures do not affect the progress of this machine. The current consumption is increased and the speed decreased in proportion to the severity of the above conditions not sufficiently to cause undue strain or injury to any part of the mechanism.

A speed of 25 miles an hour was attained, a four-cycle, four-cylinder gasoline motor being used with lubrication by the splash system and the ignition is by the Bosch high-tension dual system. The engine is direct-connected to a generator and will run with a load 200 per cent in excess of its normal rating. It is equipped with a controller designed for a maximum efficiency with the motor and gear reduction. There are two speeds forward and reverse. The controller is located under the footboard, where it may be given attention when necessary, without delay. The electric motors are especially designed so as to yield their highest efficiency at normal load; also to be very efficient at a high overload, to which the motors are subjected when traveling over a heavy road or up a steep grade. The motors are mounted on a solid forged axle knuckle and are outside of the road wheels. This meth-



Gas-Electric Steam Fire Engine.

od of mounting allows the motors to swing with the wheels and the general arrangement of the motors is such that they may readily be inspected. The axles are solid section forgings both for the front and rear. The front axle is of a frame construction. with radius rods connecting top and bottom to the frame. The axle design is specially adapted for fire-apparatus service. The wheels are four and five feet in diameter of the artillery type, mounted on Timken roller bearings, and have solid Firestone rubber tires with dual notched tread on the front wheels. The large steering wheel is on the right-hand side of the chassis. The service brakes are strong and powerful and operated by a foot pedal or by a hand lever with a notched quadrant for locking the brakes which are externally contracting and acting on drums on the rear wheels. A double-reduction transmission is used, applying the power to opposite sides of the wheel rims. The first reduction is effected in oil-tight gear casings, securely bolted at each end of the motors, and allows for the installation of sturdy, wide-faced gears. The second reduction is made by a rack and pinions on the opposite sides of the wheel rim. The housings inclosing the rack and pinions are light and neat, giving ample protection. The wheel base of the machine is 12.5 feet and a feature of the design is the wide track or gauge, thereby insuring safety in turning sharp corners, etc. The boiler is designed

to carry 125 pounds of steam and is used as a backbone to carry the steam cylinders and the pumps.

The pumps have outlet gates so that three-inch hose may be used and the fire engine is equipped all ready for fire service with play-pipes, nozzles, lanterns, suction hose, reducers, hydrant connections, tools, fire shovel and poker. The machine equipped and carrying a full crew of men tips the beam at 15,500 pounds. The front seat accommodates two men and in the rear there is room for the engineer and fireman. A foot-button on the footboard operates a powerful electrically driven Sireno horn, giving a distinctive and penetrating alarm.

Induction Control for Slip-Ring Motors.

An interesting type of speed control for slip-ring type induction motors has been brought out by the Electrical Apparatus Company, Limited, of London, England. It is unique in that it does not depend on water resistances or contacts in rotor circuit and hence sparking troubles such as are found in the usual metallic type starters, or leakage trouble found in water resistances are done away with. Moreover, infinite gradations of speed can be obtained by the apparatus. Fig. 1 shows the external appearance of the rotor regulator, while Fig. 2 illustrates a view of the induction controller before assembly.

Fig. 1.—Induction Speed Controller.

These controllers are based on a rather novel principle. Inserted in the rotor circuit are coils whose apparent resistance depends on their position in space relative to other coils which have resistances actually in series with them. In this way direct resistances are taken out of the rotor circuit. Suppose, for example, there is a magnetic core capable of turning and wound with a primary coil, while there is also a frame wound with two secondary coils at 90 degrees to one another. If one of these secondaries is closed on itself through a high resistance and the other through a low resistance, then when the primary is opposite to the former, it has, so far as alternating currents are concerned, a high apparent resistance. When turned so that the primary is opposite the second, it has a low resistance. In intermediate positions the resistance has intermediate values. A small air gap is used in the iron circuit to avoid a choking-coil effect. The controllers have an inherent electrical torque, depending on the load, which tends towards the lowest speed position. In plain controllers the operator can actually feel the pressure of the load on the motor owing to the torque on the handle of the controller. Hence the controller acts as a rough current gauge. Moreover, the motor cannot be overloaded without an unusual effort by the operator's hand. This torque is also utilized in automatic and fool-proof starters in such a way that the motor cannot be subjected to excessive current in starting, and in this way the apparatus can be used for automatically regulating the speed and load of induction motors, as is required in rolling mills and other industrial applications, without the aid of any auxiliary magnets or series transformers. At the same time sparking is impossible and the apparatus can safely be used in mines and other places where there is any risk of fire or explosion. The simplicity of the arrangement results in great reliability as well as low first cost and maintenance.

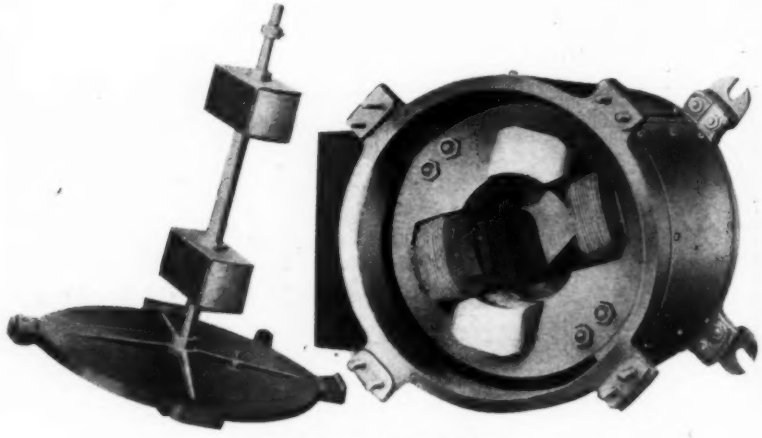


Fig. 2.—Parts of the Controller.

In Fig. 2 the spindle will be seen with cores, mica insulated, ready for winding with the movable coils, while it will be seen that the stator has three pairs of poles, one pair being surrounded by solid copper rings for full speed, the second pair with wound coils for half speed, and the third pair being unwound, for lowest speed. In the automatic slip regulators the method of operation is the application of the controlling forces, in some cases gravity and in other cases spring tension, opposed to the electrical torque of the regulator. When the load increases this torque also increases and overcomes the controlling forces, moving the regulator to a lower speed position, and vice versa.

The Reco Time Switch.

The Reynolds Electric Flasher Manufacturing Company, of Chicago and New York, is placing on the market a neat, compact, one-day time switch, inclosed in an iron cabinet. The size is 10 by 4.5 by 5 inches and the clock may be installed in any convenient place inside or outdoors, as the case is weatherproof and dustproof.

Reco Time Switch.

The clock is of standard make, specially designed for this work and requires no other attention than daily winding. The switch mechanism is

mounted on a porcelain block and the tripping arrangement is simple, yet effective and thoroughly reliable. The cabinet has a door at the back, which permits easy access to all of the winding levers, switch set, wiring, etc.

The switch was designed after much forethought and a close study of conditions, with a decision to make a strong, practical and simple device, selling at a reasonable price. From the favorable comments which have been received the company feels that its efforts have been entirely successful.

This switch is suitable for turning off electric signs, show-window lights, store or hall lights, apartment-house lights, isolated street lights, patrol-alarm systems, etc.

Keystone Midget Direct-Current Ammeters and Voltmeters.

The Keystone Electrical Instrument Company, of Philadelphia, Pa., has been perfecting for the past year a midget ammeter and voltmeter, three inches in diameter, of the highest grade for use on switchboards, auto-

Fig. 1.—Projecting-Type Ammeter.

mobile dashboards, and for portable service where a small instrument is particularly desirable.

In bringing out this instrument the Keystone Company has endeavored to reduce the number of parts required in the standard d'Arsonval system to a minimum. It is a well known fact that the d'Arsonval principle is the most accurate for direct-current measurements. Therefore, in order to reduce the costs of these small instruments and at the same time to produce high-grade, accurate instruments, much study has been given to this feature.

Fig. 1 shows the front-of-board type Keystone ammeter, and Fig. 4 the instrument with cover removed. The simplicity of construction will be evident at a glance. A tungsten-steel magnet of unusually large size is used, so that permanency can be secured and to increase the dead-beat operation of the instrument. This magnet has no separate pole pieces, the poles being accurately ground. This does away with the magnetic joint between the magnet and the pole pieces, and also increases the magnetic strength. The bases are of molded material to insulate the studs carrying the current through the switchboard or dashboard, and this material is also used so that the magnetic strength may be unaffect-

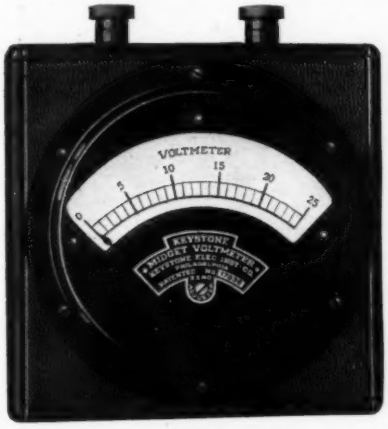


Fig. 2—Portable Voltmeter.

ed. To obtain the greatest strength from the magnets, the covers are also formed of brass instead of iron. All holes in the covers and bases are square so there is no possibility of turning of any of the parts when tightened up. The aluminum coil form, seven-thousands of an inch in thickness, on which the fine enameled wire is wound, swings in sapphire jewels between the poles of the magnet. The pointer is of aluminum tubing, twelve-thousandths of an inch in outside diameter and with a wall one-thousandth of an inch thick, and the whole moving element weighs only slightly

Fig. 3.—Flush-Type Ammeter.

over one-tenth of a gram, or the weight of one common pin. With a moving element so exceedingly light as this the instrument is absolutely dead beat in operation, and the pointer does not oscillate, even when the instrument is subjected to severe vibration. This exceedingly light moving element also has the advantage that there is practically no weight whatsoever on the pivots and bearings, assuring long life for the instrument. The scale is white-enameled on brass except where black scales with white letters are preferred. Each instrument is equipped with a zero-adjusting device by means of which the pointer can be readjusted to zero at any time from the outside of the case.

In Fig. 3 is shown the flush-type instrument, 3.25 inches outside diameter, and in Fig. 2 the portable type, the instruments having a scale 2.25 inches long, which affords a clear legible scale for easy reading.

The Keystone Electrical Instrument Company has for the past 18 years been manufacturing high-grade ammeters and voltmeters, and it naturally has excellent facilities for designing, assembling and calibrating instruments of this character. It has been on account of the design of the instrument with such a small number of parts, and on account of the large

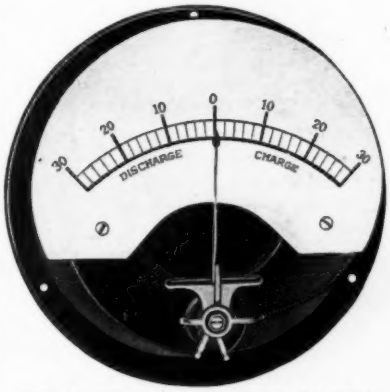


Fig. 4—Ammeter with Cover Removed.

quantity in which it is possible to manufacture them that it is possible to produce this high-grade instrument at low cost.

These new Keystone instruments are of particularly attractive appearance, being furnished in either dull rubber finish or full nickel plate. The instruments will prove of particular interest where a high-grade instrument of small size is desired, whose accuracy can be relied upon.

The New Adapti Threadless Fitting.

One urging the advantages of conduit wiring over other classes of wiring construction rather frequently encounters the contention that this is a sort of work which requires a much greater amount of time and much more skill on the part of the workman than

wiring of any other sort. It is claimed in fact that in many localities it is very difficult to find workmen who can do a good job of conduit construction. In answer to contentions like this it may very well be said that the wireman has to learn to install any sort of wiring before he can be depended upon to put it in properly, and it is about as easy to learn to install the commoner types of work in which metal-clad circuits are employed as to learn to do a really high-class job of knob-and-tube work.

Nevertheless, anything which tends to simplify conduit construction and enable it to be done more quickly and better, is a great advantage. A conduit fitting lately introduced by the Adapti Manufacturing Company, Winter and Leonard Streets, Cleveland, O., should fulfill this requirement. The fitting is shown in Fig. 1. This is the ADAPTi Threadless Fitting, for attaching conduits to Adaptiboxes.

New Adapti Fitting.

With this new threadless fitting the necessity of threading the end of the conduit and of using bushings and locknuts is eliminated, the end of the pipe being inserted in the fitting, which is attached to the outside of the box, and secured in place by means of a tangent screw, the head of which bears on the conduit. The head is of the filister type, and the method employed in inserting it in the lug is such that a pull on the conduit tends to tighten the screw and thus bury the head deeper in the metal of the pipe. The screws used are all case-hardened. Recent careful tests prove that the electrical conductivity obtained with a joint of this kind is better, it is said, than that obtained by couplings of the threaded type.

This fitting has been approved by the Underwriters' Laboratories for half-inch and three-quarters-inch conduits when used with any of the Adaptiboxes.

Pump Motor in Steady Service After Flood.

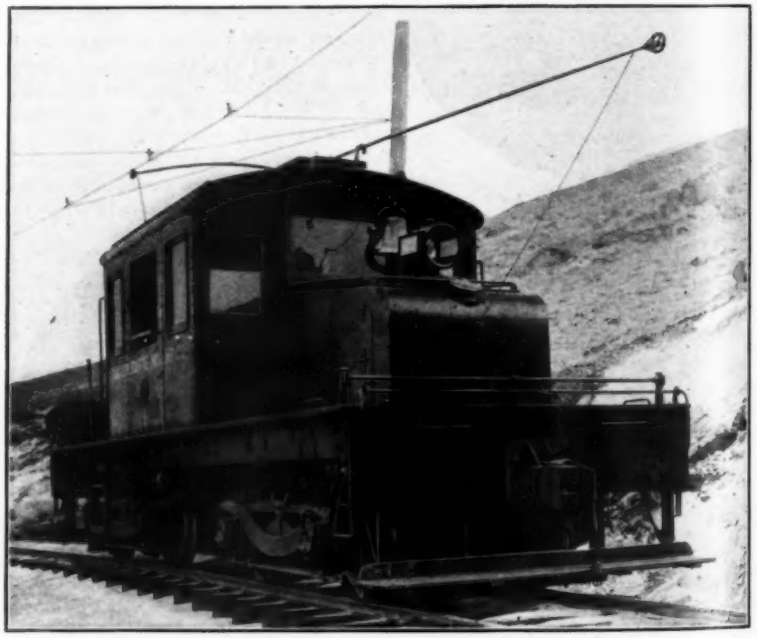
Pump Motor Proves Reliable After Submergence in Flood.

About a year ago the pump house of the Breese, Ill., pumping station was flooded with water, entirely covering the Wagner 30-horsepower single-phase motors, which drove the pumps. As it was necessary to keep up the water supply for the town, Mr. Carr, the superintendent, decided to try to pump out the pit with one of the motors while the same was still under water, expecting to damage it by so doing. The motor was started, the pit pumped out, and the motor was found to be intact. The motor has been in constant operation since that time and, with the exception of mud in the short-circuiting device and the commutator, is in perfect operating condition.

The illustration shows one of the motors connected to its pump. The white line on the wall behind the motor indicates the high-water mark at the time of the flood.

A Forty-Ton Electric Switching Locomotive.

Within the past few years the applications of electric locomotives to many phases of industrial service has become very extensive. One of the many uses to which these locomotives have been put is for switching cars in a manufacturer's private yard, thus eliminating the switching charge made by steam railroads, and also doing away with the fire hazard from sparks and glowing cinders to the buildings and material in the vicinity.



Industrial Switching Locomotive.

Often a manufacturer is compelled to haul his raw material and finished product a considerable distance to and from his plant in order to connect with a steam railroad. One notable example of such a condition is that of a certain brass manufacturer who had to use 144 horses to haul his raw material and finished product a distance of one mile and a half before employing electric locomotives.

Locomotives for this service are economical power consumers, in view of the fact that slow-speed motors are used which do not make excessive demands on the power house. Often no additional generating apparatus is necessary to that already installed.

The Timber Butte Milling Company, of Butte, Mont., has recently put into service a 40-ton Baldwin-Westinghouse electric locomotive. This locomotive is being used for hauling materials to the concentrator site, and as soon as the concentrator is in producing operation, the locomotive will haul the concentrates to points on Montana Street, where switching connections have been established with the Chicago, Milwaukee & St. Paul, the Northern Pacific, the Butte, Anaconda & Pacific, and the Great Northern railroads.

The mechanical parts for this locomotive were built by the Baldwin Locomotive Works, Philadelphia, Pa. The electrical equipment, which is of the very latest type for this class of service, consisting of four 90-horsepower, 500-volt, commutating-pole motors especially designed to give good commutation at all loads found in normal service, and the unit-switch control system was furnished by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

The frame of these motors consists of a one-piece steel casting with large openings bored out at each end for the bearing housings and for taking out the armature endwise. The weight of the motor on the axle is carried almost entirely by a solid bracket extending over the axle. The split of the axle caps is such that the weight of the motor is taken off the axle cap bolts, thus greatly reducing troubles at this point.

These bearings are carried in housings which are carefully seated in the field frame in bored and flanged seats and are held by five large bolts. Safety suspension lugs provide an additional safeguard, being so arranged that should the main suspension lug break, the motor would not drop but a few inches onto the truck suspension bar.

Westinghouse type-HL unit-switch control used on this locomotive is similar to the control used on a large number of interurban roads throughout the country. It is especially adapted to locomotive service, where circuits carrying heavy currents must be broken, requiring positive and reliable switching apparatus.

New Factory Plant Under Construction for Tungstolier Works.

A Great Fixture Plant.

The expansion in the lighting fixture lines manufactured by the Tungstolier Works of the General Electric Company and the growth of the service idea in connection therewith has brought about a condition where the present plant is wholly inadequate to take care of the demand. Although one of the industry's best equipped plants, which has turned out quality lighting fixtures to the extent of hundreds of thousands in the past 10 years, the present Conneaut factory is being replaced with an entirely new plant at Cleveland, Ohio, which will commence operation on July 1.

A unique plan to be known as the "Certificate System" will be inaugurated in connection with the manufacture of the product, this system insuring a full measure of success under the company's policy of the best possible goods in the quickest possible time.

The accompanying illustration shows in part the new building nearing completion. With an increased area of 200 per cent over the present facilities there is ample promise of satisfactory service to Tungstolier customers.

Meter-Testing Tables for Laboratory Use.

The importance placed on accuracy of watt-hour meters is now so marked that central stations have generally established special meter departments, among whose duties are the periodic testing of customers' meters. Some of this work cannot be conveniently or properly done on the customers' premises and to facilitate it has brought about the equipment of special test rooms or laboratories in the headquarters of the meter department.

The States Company, 19 New Park Avenue, Hartford, Conn., has specialized on the design and manufacture of portable apparatus and laboratory equipment for meter testing. Some of the latter will be described in this article. In this group are included several types of tables completely, compactly and conveniently equipped with all the switches, terminals, loads and other necessary apparatus. One of these is shown herewith. The framework is of 1.25-inch pipe assembled with standard switchboard pipe fittings. The upright portion consists of one or more slate panels carrying the load switches, binding-posts, means for mounting the meter under test, etc. The table working surface or bench is usually made of birch or maple in which the rotating standard meter is commonly set so as to be flush with the top.

Meter-Testing Table.

For the sake of both economy and safety, low-voltage current is used for the load; this is provided through a step-down transformer of the potential type with primary connected across the line voltage and secondary connected to

the various adjustable resistances constituting the load. By means of the numerous switches provided, the load may be adjusted to any current from one-quarter ampere to the capacity of the table.

All the tables are completely wired and require merely connection to the supply circuits of the laboratory. The load is practically non-inductive, so that the power-factor is 99 per cent, or between this and unity. If meters are to be tested at lower power-factors, a special potential phase-shifter can be mounted on the table to produce any desired value of power-factor.

As stated above, several standard types of test tables are made to suit the needs of central stations of various size. For very small plants that cannot afford a complete testing table separate load panels can be provided to be mounted on an ordinary work-bench or other suitable framework.

Victor Series Alternating-Current Motors.

There is a constantly increasing demand for small series type motors for operating on alternating-current circuits. Many manufacturers and users of small motor-driven apparatus must have variable speed in order to obtain a maximum of efficiency from their machines. This variation of speed can only be obtained through two methods: mechanical control or electrical control. Mechanical control is not nearly so efficient as electrical control, and on many kinds of apparatus, is entirely impracticable. Electrical control, on the other hand, can best be obtained only from a series-type motor, on alternating current, and owing to the difficulties of manufacturing such a motor, there have been but few thoroughly reliable and durable motors of this class on the market.

The Victor Electric Company, of Chicago, has recently brought out a series-type alternating-current motor in which all of the objections formerly advanced to this type of construction are said to have been entirely overcome. This line is designated as type B33. Practically sparkless commutation is obtained in these motors. This commutation, in fact, can be favorably compared to the commutation of direct-current motors. Years of experimental work have been required to bring this line of motors to this stage of perfection and the most exhaustive tests have been made with the result that, as they now stand, these motors give practically the same service as direct-current motors.

In a recent test a one-eighth horsepower motor was placed on a 110-volt, 60-cycle circuit under full load and allowed to run continuously for 10 hours each day, over a period of nine months. Another motor of the same description was placed on the same circuit, without load, and allowed to run in the same manner, for the same period. At the end of the period a slight corrosion of the commutators was noted, a small amount of wear was also observed on the brushes of each motor. Aside from this, no bad effects were noted.

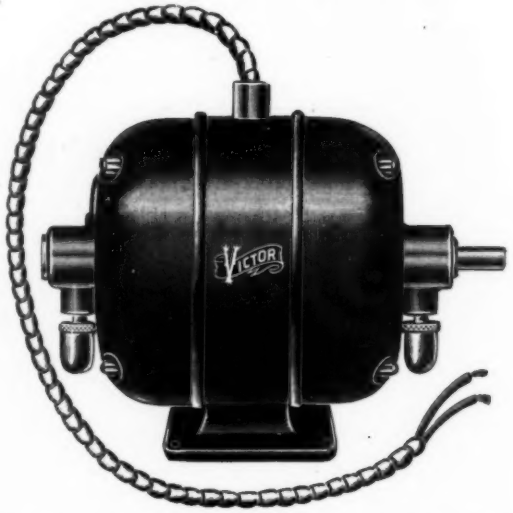
The motors are built in two sizes, one-eighth and one-sixth horsepower. They are designed for operation on 110 volts, 60 cycles; 220 volts, 60 cycles; 110 volts, 25, 30 or 40 cycles; 220 volts, 25, 30 or 40 cycles. Both sizes of these motors are built in the same frame, the size of which is approximately 6.5 inches wide, 7 inches high and 9.75 inches from end to end of the shaft, the shaft protruding from the end bearing 1.125 inches.

The field, as well as the armature cores are built up of very thin and specially annealed Swedish iron lamentations. The commutator is made of special copper composition which is tougher and wears better than pure copper. The brushes are moderately wide and flat and are of the highest grade of imported carbon.

The motors are finely finished in black japan and nickel and are artistic in design. They are made either semi-inclosed, entirely inclosed with the exception of external binding-posts for connecting to line, or entirely inclosed without external binding-posts, the leads in this instance being brought out at the top of the motor and incased in flexible-steel conduit.

These motors are especially adapted for the operation of any apparatus requiring full torque, such as washing machines, vacuum cleaners, carbonators, and the many other devices that are likely to be overloaded at some time. There are no starting devices. The speed can be controlled with a separate rheostat similar to those used on direct-current motors. This method of speed control does away with the objectionable features encountered where the brushes are shifted, and gives a maximum of power on the various speeds.

Semi-Inclosed Series Alternating-Current Motor.



Totally Inclosed Series Motor with Flexible Conduit for Leads.

Avoiding Technical Terms.

The following extract from a recent letter to one of the manufacturers of electric fans shows a customer's effort to make the company understand what was needed to put his fan in working order—"will say that the part I want is the wires on the inside of the stand. it is the fine wire that is wrapped in a cone shape, it lays around the part that holds the fan. It is not the wire that is wrapped around the shaft that turns, but the wire that lays still and wrapped on the outside of the one that turns, the insulation is burnt off, the number of the fan is ——. Please give me your price on this."

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

WHITE, S. D.—An electric light system is to be installed here. C.

MONTROSE, S. D.—G. Vandyke will install an electric lighting system here.

DULUTH, MINN.—J. J. Fray proposes to install 100 electric lamps on Main Street.

ST. THOMAS, N. D.—St. Thomas will install an electric light plant at a cost of $7,000. C.

ARKADELPHIA, ARK.—The Arkadelphia Electric Company is planning to overhaul its distribution system.

LYNVILLE, IOWA.—The question is being agitated of the proposition of installing an electric light system.

DUNKIRK, IND.—The Muncie Electric Light Company has been granted a 50-year franchise by the City Council of Dunkirk.

NEWCASTLE, PA.—The Council is planning to install a $200,000 municipal plant. Address Walter Tyler, mayor, for information.

SIOUX CITY, IOWA.—The Sioux City Service Company will install new dynamos to double the capacity of its power plant. Z.

KENMARE, N. D.—An ornamental lighting system is contemplated by the business men of this place. Mayor Cole is interested. Z.

BARBERTON, O.—The council is planning to install a $100,000 municipal lighting system. The city clerk has the matter in charge.

PARIS, ILL.—The Chamber of Commerce has under contemplation plans for installing ornamental lights in the business district. Z.

HOLLANDALE, WIS. — Herman Azzalino, Sr., is preparing to install an electric light plant here, obtaining water power from the River.

TOLEDO, O.—An ordinance has passed the Council providing for placing all the electric wires in metal conduits. Address the city auditor.

IDA GROVE, IOWA.—The Holstein Service Company has been formed here. Henry Dessel is president. An electric light plant will be built.

ABILENE, TEX. — The Fulwiler Electric Company has been incorporated with a capital stock of $25,000 by W. J. Fulwiler, G. T. Scales and others.

NEW YORK, N. Y.—Bids will be received July 7 for supplying from one to ten motor trucks. Address M. Gray Zalinski, Depot Quarter Master.

CEDAR FALLS, IOWA.—The City Council has decided to sell $50,000 worth of bonds for the construction of a municipal electric light plant.

BOLIVAR, O.—Bolivar Light & Power Company has been incorporated with a capital stock of $10,000 by H. L. Lash, Joe C. Becker, G. E. Bowen and W. B. Ramsey.

LA CROSSE, WIS.—Nearly $150,000 will be spent by the La Crosse & Electric Company, in the improvement and enlargement of its plant this year. C.

VERSAILLES, ILL.—The Village Board has granted a franchise to the Central Illinois Public Service company of Mattoon to supply power in Versailles. Z.

BIRMINGHAM, ALA.—The Kelley Company is planning to construct a $250,000 electric power plant here for the proposed 17-mile railway. W. E. Kelley is manager.

WATERLOO, IOWA.—The Citizens Gas & Electric Light Company will expend the sum of $600,000 in improvements in the city during the next two years. C.

WOODLAND, CAL.—The Oro Electric Corporation has purchased a franchise for a power and light line under and above all streets and highways in Yolo County.

TELLICO PLAINS, TENN.—Tellico Power Company contemplates the construction of a hydroelectric plant to develop 4,000 horsepower, which will cost about $400,000.

SPRINGFIELD, ILL.—Arthur M. Morgan, consulting engineer, of Chicago, has submitted plans for consolidating the light and water system, the cost to be about $35,000.

ANACORTES, WASH.—The Anacortes Light, & Water Company, recently incorporated with a capitalization of $300,000, proposes making extensive improvements here. O.

BOWBELLS, N. D.—The establishment of an electric light plant for this town is under consideration. The cost will be about $4,000. Address the mayor for desired information.

BOISE, IDAHO.—The Beaver River Power Company has been granted a franchise to enter Pocatello. E. P. Bacon is general manager. The company will extend the line at once.

AUDOBON, IOWA.—Mr. Wieland of Walnut, Ill., has purchased an interest in the light plant here and will rebuild the old into a new and powerful plant, capable of supplying several towns.

INDIANAPOLIS, IND.—Bids will be received June 4 for furnishing the new chapel with electric-light fixtures. Architect Adolph Scheier, Indiana Trust Building, has prepared plans.

VALLEY FORGE, PA.—The Phoenixville, Valley Forge & Stratford Street Railway Company, has started surveys on its proposed electric railway from Valley Forge to Bridgeport.

CALGARY, B. C.—The Bowness Investment Company will receive tenders until May 31 for power machinery and equipment as per plans and specifications on file in the local office. O.

READING, PA.—The Pinegrove Electric Light, Heat & Power Company has purchased a site and will erect a power house here for the development of light and power for that borough.

MONTEREY, TENN.—An electric light franchise has been awarded to George N. Welch, T. E. Goff and J. T. Price. They will begin work at once. The estimated cost of the plant being $5,000. G.

ALEDO, ILL.—The Consumers' Light & Power Company contemplates improvements to its electric light system here, if a new franchise is granted. It will cost between $50,000 and $200,000. Z.

STERLING, ILL.—Rock River Light & Power Company has been incorporated with a capital stock of $300,000 to operate heat, light and power plants. The incorporators are H. H. Wood, Edwin F. Lawrence and H. S. Green.

CHATTANOOGA, TENN.—Merrill B. Parker is in the market for a second-hand 40-horsepower 125-volt direct-current motor. He is also asking prices on a used 8-horsepower 125-volt direct-current motor. G.

MT. STERLING, KY.—This city is considering the establishment of an ornamental street lighting system, the Federal Sign System of Louisville, Ky., having interested the merchants of the town in the proposition. G.

SOMERSET, PA.—A charter has been issued to the Somerset Electric Company to furnish light in Somerset. The capital stock of the company is $5,000 and J. A. Berkey, C. L. Shaver and P. G. Cober are named as the incorporators.

BAKER, ORE.—Mayor Palmer has been instructed by the City Commissioners to employ an engineer to estimate the cost of the installation of a complete electric light system. The officials promise that the work will be pushed to completion.

HARRISBURG, PA.—Charters have been issued to the Lancaster County Water & Power Company, Buchanan Water & Power Company, Lafayette Water & Power Company, Hamilton Water & Power Company and Stevens Water & Power Company.

SANTA ROSA, N. M.—C. R. Jones is promoting the erection of a hydroelectric plant near here. It is planned to also construct a system of power transmission lines. It is claimed that the Santa Rosa Rito River affords an abundant supply of water for generating the necessary electrical energy. Mr. Jones holds an option on the water rights of this stream.

LANSING, MICH.—The Railroad Commission has authorized the Michigan & Chicago Railway Company to issue

$3,512,000 in bonds to cover the expense of providing terminals, tracks, etc., for the road in Grand Rapids; a hydroelectric power plant on the Manistee River and certain extensions of its lines.

CEDAR RAPIDS, IOWA.—Consulting Engineer Hedrick, of Kansas City, Mo., has informed the City Council that for $200,000 the city can build an eight-foot concrete dam near the present dam, build a power house and equip it to develop from 400 to 1,500 horsepower per day.

SPOKANE, WASH.—The Washington Water Power Company recently announced its intentions of furnishing electric light and power to several towns in the Palouse Country and eventually to farmers along the transmission lines. Several towns have accepted the proposal of the company.

NEWPORT, WASH.—The International Power & Manufacturing Company is preparing to spend between $5,000,000 and $7,000,000 on the development of electrical energy. The site of the power plant is about 18 miles below this city. Wilbur S. Yearsley, of Spokane, is vice-president of the company.

NEWARK, N. J.—The Common Council has instructed its Committee on Public Buildings to investigate the cost of increasing the capacity of the electric lighting plant in the City Hall by the installation of a new 50-kilowatt generator and new engine, in accordance with suggestions made the Board by Engineer Gottfried Dries.

DAWSON, YUKON TERRITORY.—The power house of the Dawson Electric Light & Power Company was recently destroyed by fire, entailing a loss of approximately $200,000, and leaving the city entirely without light, electric power and water, as the power plant pumped water for the entire city. Work of reconstruction will begin at once. O.

ST. JOHNS, ARIZ.—The Nebo Light & Power Company and the St. Johns Electricity & Power Company will erect hydroelectric plants near here for the purpose of supplying power for irrigation pumping plants and other industrial concerns of this section as well as to provide lights for St. Johns. The two companies are closely affiliated in their management. D.

ASTORIA, ORE.—The Pacific Power & Light Company has applied to the County Courts for permission to extend its service of power and light to the West Side. W. H. Galvania is construction engineer for the company and the company also plans extending its street car lines over the new Smith Point route to be created by the opening of Alameda Avenue. Plans are being formulated and it is reported construction work will begin this summer. O.

BOISE, IDAHO.—By a transaction of more than ordinary importance the Crane Falls Power Company's power site on the Snake River, was merged with the Idaho-Oregon Railway Light & Power Company, for a consideration not revealed. This is taken to mean the early development of a big enterprise which has been delayed by a number of factors. The new management proposes constructing a power plant at Crane Falls as soon as possible to develop the Gem district.

POCATELLO, IDAHO.—The Utah Light & Power Company, successors to the Telluride Power Company owning a 25,000-horsepower hydroelectric plant on the Bear River, has been granted permission to enter the Bannock County field as a competing electric light and power company. The concern has been granted electric light franchises at Downey, McCammon, Bancroft and Soda Springs, and is at the present time constructing a power plant at The Narrows, on the Bear River. O.

AUSTIN, TEX.—The Colorado River Power Company, which is headed by C. H. Alexander, of Dallas, recently filed on the water rights of a section of the Colorado River above Austin, preliminary to constructing a large dam and erecting a hydroelectric plant at a point about 40 miles north of here. Mr. Alexander and associates also have under consideration the construction of a dam over the Colorado River near Ballinger to cost approximately $1,000,000. This latter dam will be for the purpose of creating a water storage reservoir for irrigating about 75,000 acres of land in that section. D.

HARRISBURG, PA.—Charters have been issued to W. Fred Snyder, Philadelphia; John Batbey, Reading; Frank Battles, Newton Square; S. L. Wright, W. Redwood Wright and W. T. Bilyou, Philadelphia; for the following electric companies to operate in Bucks County, each with a capital stock of $5,000: Borough of Dolyestown Light; Buckingham Light; Borough of Bristol Light; Dolyestown Light, Falls Light; Lower Makefield Light, Upper Makefield Light, Morrisville Light, Newton Light, New Hope Light, Solebury Light, Taylorsville Light, Wrightstown Light and Yardley Light Companies.

BENSON, ARIZ.—It is authoritatively announced that the project of erecting a great hydroelectric plant and the construction of an extensive system of power transmission lines to cover parts of Arizona and New Mexico has been financed and that details of the organization of the company will soon be made public. Ralph Cameron, one of the best known public men in Arizona, and associates, are the promoters of this enterprise, and claim to have the necessary financial support to assure the consummation of the project. It is claimed that the company will have a capital stock of $15,000,000. It is understood that the plant will probably be located on the Gila River. D.

PORTALES, N. M.—The Portales Power & Irrigation Company and the Portales Utilities Company have just been organized, the former with a capital stock of $300,000 and the latter with $717,600 capital stock. The two companies are owned by the Westinghouse Electric Company. The incorporators named are A. A. Rogers, S. E. Ward and M. V. Peasles. The Portales Power & Irrigation Company owns the large central power station and system of transmission lines by which means electric power is furnished for operating many irrigation pumping plants in this section. The Portales Utilities Company has taken over the Public Utility plants and systems in the town. The power transmission system will be extended and improvements will also be made to the local utility plants. D.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

ALICEVILLE, ALA.—Elbert Noland has been granted a franchise by the City Council to build a telephone exchange.

LODI, WIS.—The Lodi Telephone Company will improve its telephone system. Address the secretary for information.

VESTA, MINN.—The Underwood Rural Telephone Company has been incorporated by Arthur Falk, B. J. Dunne and others.

ANAHEIM, CAL.—The Pacific Telephone & Telegraph Company has been granted permission to establish an exchange in Placentia.

ELCHO, WIS.—Elcho Telephone Company has been incorporated with a capital stock of $1,000 by C. W. Fish, E. A. Morse and L. P. Trademill.

NEAPOLIS, O.—The Neapolis Telephone Company has been incorporated with a capital stock of $5,000, by E. R. Wilson, T. W. Studer and others.

KANSAS CITY, MO.—The Home Telephone Company will erect a telephone exchange and $250,000 will be expended for improving the telephone system.

BROWNSVILLE, KY.—The Tarter Logan Telephone Company has been incorporated with a capital stock of $3,000 by O. N. Tarter, D. A. Logan and others.

GUTHRIE, OKLA.—The Guthrie Southwestern Telephone Company has been incorporated with a capital stock of $200 by W. N. Kellogg, C. P. James and others.

SPRINGFIELD, ILL.—City Electrician Fred Spears has recommended to the City Commission the installation of an improved system of police and fire-alarm signals. Z.

PEORIA, ILL.—City Electrician Wolgamott has recommended to the City Council that the fire and police-alarm system be placed underground and that the system be enlarged. Z.

LEWISTON, IDAHO.—The Lewiston Orchard Rural Telephone Company, W. H. Bankson, president, will build a telephone line to serve Lewiston Orchards. Ten miles of wire will be used. O.

EUGENE, ORE.—The Western Union Telegraph Company will build a line from Eugene to Florence during the summer, according to G. E. Duzan, of the construction department of the Company. O.

PORT ANGELES, WASH.—The National Forest Reserve will build a telephone line from the Ennis Creek Station to the Elwha post office, a distance of about 11 miles, work to be in charge of Supervisor Fromme. O.

VANCOUVER, B. C.—The British Columbia Telephone Company, Limited, has prepared plans for the laying of a submarine cable across Saanich Inlet, between a point on the east shore of Saanich Inlet to Vancouver Island, B. C. Work will begin shortly. O.

TRADESVILLE, PA.—The Chalfont Rural Telephone Company has been organized here. Those participating in the organization are Mr. and Mrs. Louis D. Garner; Mr. and Mrs. Samuel Lapp; Mr. and Mrs. H. P. Weisel, William Lapp, Norman Kratz, Arthur Lapp and G. C. Albright.

ELECTRIC RAILWAYS.

(Special Correspondence.)

DEVILS LAKE, N. D.—The Chautauqua railway will be electrified this season. C.

PEORIA, ILL.—Local officials of the Peoria Railway Company have received an authorization to lay a double-track on Main Street.

DES MOINES, IOWA.—F. C. Hubbell, president of the Greater Des Moines Committee, is actively interested in promoting the proposed interurban line from this city to Red Oak.

GAINESVILLE, TEX.—The Commissioners' Court has granted an exclusive franchise to E. P. Turner and associates of Dallas, to build an interurban railway company in this county. Z.

MONTEBELLO, CAL.—A committee which has been in conference with officials of the Pacific Electric Railway made a favorable report on the possibilities of a car line to this city.

SAN FRANCISCO, CAL.—The South San Francisco Railroad & Power Company has been granted a franchise to construct and operate an electric railroad along Walker and Swift Streets and Grand Avenue.

ZANESVILLE, O.—The Ohio Electric Company has been granted the right by the Public Service Commission to issue $3,500,000 in bonds with which to refinance its road, which is made necessary by the recent damage by floods.

TRENTON, N. J.—The public Service Corporation will extend its electric traction system in Hamilton Township from Broad Street Park to Groveville, by way of Yardville, with a branch line on the Mercerville Road to the Burlington County line. A.

ST. LOUIS, MO.—It has been announced that the Springfield & Southern Illinois Traction Company is preparing to build an interurban line to Terre Haute, Ind., with a branch to Cairo, Ill. Isaac A. Smith, a St. Louis engineer, is president of the company.

MEMPHIS, TENN.—The Memphis & Lake View Railway Company has been incorporated with a capital stock of $50,000, to engage and operate, to construct and maintain interurban roads. The incorporators are T. H. Tutwiler, L. E. Wright, of Memphis, Tenn., and others.

CLEVELAND, O.—The Cleveland & Akron Short Line Railway Company, backed by Clevelanders to build an interurban, has been incorporated with a capital stock of $25,000. According to Attorney John C. Chapman, one of the incorporators, most of the private right of way has been obtained and the route of the new line will pass through Brooklyn, Independence, Brecksville, Everett, Barberton and Portage.

POCATELLO, IDAHO.—From an authentic source comes the information that the Oregon Short Line is seriously considering the electrification of its entire railroad system in Southern Idaho, from Montpelier on the east to Huntington on the west. The report states that the company has asked electrical power concerns to submit bids for furnishing power, basing their figures on necessary power to operate the entire southern Idaho system. O.

PROPOSALS.

RADIO SETS.—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 3 for five radio sets, to be delivered at the Navy Yard, Brooklyn, N. Y., as per schedule No. 5,440.

INSULATED CABLE, ETC.—Sealed proposals will be received at the Engineer Depot, U. S. Army, Washington Barracks, D. C., until May 27, for furnishing cambric insulated cable, and until May 28 for furnishing cable hangers and screws. Further information may be obtained upon application.

ELECTRIC ELEVATOR.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until June 9 for the installation complete of an electric passenger elevator in the post office at Bismarck, N. D., in accordance with drawing and specifications, copies of which may be obtained from the Supervising Architect.

ELECTRIC HOISTS.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 14 for furnishing and installing three electric hoists at the Naval Radio Station, Radio, Va., in accordance with plans and specifications, copies of which may be obtained upon application to the Bureau.

FOREIGN TRADE OPPORTUNITIES.

(Parties interested in the following items should address the Bureau of Foreign and Domestic Commerce, Washington, D. C., and refer to the file number noted.)

NO. 10,873.—MACHINERY AND EQUIPMENT FOR A LIGHT AND POWER COMPANY.—An American consular officer in a European country has forwarded a pamphlet explanatory of an important industrial undertaking being organized in his district, which may offer favorable opportunities for the sale of certain classes of American goods. A company has been formed for the erection of coke ovens, installation of a coal sorting plant, an electrical station for supplying current to industrial establishments, and to conduct general commercial and industrial works.

NO. 10,907.—LIVE MARKET FOR ELECTRICAL GOODS IN GERMANY.—Vice Consul General James L. A. Burrell, of Dresden, transmits the following suggestive notes furnished by an American civil engineer, who has been engaged in business in Germany for many years: In view of the great number of parquet and tile floors, as well as mosaic work, on the Continent, electric-driven, floor-finishing machines with rotary brushes would be appreciated if they could work close in to side walls. For making connections on insulated wire there are no good skinning pliers, so that very often a defective joint implies overhauling the whole line. Socket regulators for incandescent electric lamps permitting the turning of light high or low are needed here. I find no good expansion boring tools for sale and few in use. Such light tools could be exported to Germany at a profit. Full information will be found in the report, and copies may be obtained from the Bureau.

NEW INCORPORATIONS.

WILMINGTON, DEL.—The Best Electric Company has been incorporated with a capital stock of $50,000 by Harry W. Davis, of this city.

UTICA, O.—The Utica Gas & Electric Company has been incorporated with a capital stock of $30,000 by J. M. Kirkpatrick, Henry P. Kirkpatrick and others.

WILMINGTON, DEL.—The Franklin Railway Supply Company has been capitalized to the extent of $1,000,000 by William J. Maloney, of this city. N.

EDNA, TEX.—Edna Electric Light, Ice & Water Company, of Edna, has been incorporated with a capital stock of $20,000 by L. E. Ward, Rudolph Linmartz and W. W. McCreary.

CHICAGO, ILL.—LaSalle Light Company has been incorporated with a capital stock of $10,000 to deal in electrical supplies. The incorporators are A. G. Anderson, G. S. Anderson and K. C. Loehr.

ALICEVILLE, ALA.—The Aliceville Electric Company has been incorporated with a capital stock of $6,500 by B. H. Somerville and others, to establish an electric light plant.

CHICAGO, ILL.—The Dean Engine Company has been incorporated with a capital stock of $10,000 to manufacture engines and motors. The incorporators are George A. Chritton, N. B. Dearborn and D. C. Thorsen. Z.

SPRINGFIELD, MASS.—Brown-Gates Company has been incorporated with a capital stock of $50,000 to deal in gas and electrical appliances. The incorporators are H. O. Brown, Percy S. Gates and Mary A. Drenman.

CHICAGO, ILL.—The Singer Electric & Machine Company has been incorporated with a capital stock of $1,000 to manufacture machinery and tools. The incorporators are Frank E. Scott, Frederick O. Singer and I. S. Wells.

CHICAGO, ILL.—Corn Belt Utilities Company has been incorporated with a capital stock of $2,500 to operate electric plants. The incorporators are Llewellyn M. Willey, Frederick E. Koehle and Clarence A. Toolen.

INDIANAPOLIS, IND.—The Page Electric Starter Company has been incorporated with capital stock of $10,000 to manufacture starting means for internal combustion engines. The directors are Carl M. Page, Leon T. Leach and A. C. Wells. Z.

DOVER, DEL.—The American Mining & Power Company has been incorporated with a capital stock of $6,000,000 for the purpose of prospecting for, purchasing, etc., all kinds of mineral lands. The incorporators are Willard B. Jones and M. M. Mays, of New York City.

PORTLAND, ME.—Danville, Champaign & Decatur Light Company has been incorporated here with $3,700,000 capital stock. The company proposes to construct, purchase and lease electric railways and furnish light. Philip I. Jones is president of the new corporation.

HOOSICK FALLS, N. Y.—Specialty Insulation Manufacturing Company, Incorporated, has filed articles of incorporation with a capitalization of $30,000 for the purpose of manufacturing all kinds of insulation articles. The incorporators are Michael Casey, William P. Wood and Clinton Bateholts.

FINANCIAL NOTES.

Paris, Tenn., will receive bids until May 27 for $65,000 five-per-cent 30-year sewer and electric light bonds.

E. T. Norton, broker, of Wheeling, W. Va., has bought the visible assets of the National Telephone Company of Pennsylvania at public auction. The sale was made on a court order to satisfy a mortgage to secure $200,000 bonds. The sale includes the entire plant of the company in Washington county, exchanges and long-distance connections with Pittsburgh and Wheeling independent telephone systems.

The Columbus, Marion & Bucyrus Railroad Company has been sold to the Troy (N. Y.) Trust Company as trustee for the bondholders, for $103,000, two-thirds of its appraised value. The road consists of eighteen miles of electric line operating between Marion and Bucyrus, Ohio, an extension of the Columbus, Delaware & Marion Railroad Company, which also is in the hands of a receiver. The company has bonds outstanding of $500,000 and unpaid interest and other debts add $150,000 additional to the liabilities. The bondholders will organize a new company, take over the property and make many improvements, including a new power house. James H. Caldwell of Troy, N. Y., is chairman of the bondholders' committee.

The board of governors of the New York Stock Exchange have approved applications to list the following securities: Kings County Electric Light & Power Company's $543,000 six-per-cent convertible debenture bonds, due 1925, with authority to add $1,957,000 additional of said debenture bonds on notice of issuance in exchange for outstanding temporary receipts, making the total amount authorized to be listed $2,500,000. Virginia Railway & Power Company's $500,000 first and refunding mortgage five-per-cent bonds, due 1934, making the total amount listed $11,503,000.

The Columbus Railway, Light & Power Company has made application to the Ohio Public Service Commission for authority to issue $1,353,930 of its common stock, this stock to be used as follows: For working capital, $500,000; to pay indebtedness of underlying companies to Columbus Railway & Light Company, $534,630; to purchase bonds of Columbus Railway Company and the Columbus Light, Heat & Power Company, now owned by the Columbus Railway & Light Company, $319,300. The entire stock issue is to go to the Columbus Railway & Light Company, the money represented by the new stock having been expended in betterments on properties of underlying companies. In connection with this application an appraisement of the properties of the Columbus Railway & Light Company, made by Stone & Webster, was filed with the commission. This places the physical valuation of the street railway, electric lighting and power and heating properties at $12,457,474, exclusive of franchise or good will.

Dividends.

American Railways Company, regular quarterly dividend of 1.5 per cent on the common stock, payable June 14 to stock of record May 31.

Chippewa Valley Railway, Light & Power Company, a quarterly preferred dividend of 1.75 per cent, payable June 1 to stock of record May 31.

Citizens' Traction Company, a semi-annual dividend of three per cent, payable May 16 to stock of record May 10.

Columbus Railway Company, regular quarterly dividend of 1.25 per cent on its common stock, payable June 2 to stock of record May 15.

Grand Rapids Railway, a quarterly common dividend of one per cent, payable June 2 to stock of record May 15.

Ontario Power Company of Niagara Falls, the regular quarterly dividend of 1.25 per cent, payable June 2 to stock of record May 26.

Philadelphia Electirc Company, a quarterly dividend of 1.75 per cent, payable June 14 to holders of record May 22. This is an increase of one-quarter per cent over the previous disbursement which was made on February 20, and places the issue on a seven-per-cent per annum basis.

Southwestern Utilities Corporation, initial dividend of 0.5 per cent, payable June 2 to stock of record May 20.

Reports of Earnings.

AMERICAN LIGHT & TRACTION.

The American Light & Traction Co. reports earnings as follows, for the twelve months ended March 31, 1913, as compared with preceding year:

	1913	1912
Gross	$4,320,370	$4,104,550
Expenses	117,489	118,356
Net	4,202,881	3,986,193
Dividends	3,346,302	3,112,363
Surplus	856,597	873,830
Total surplus	8,888,790	8,032,211

Surplus for twelve months was at the rate of 25.9 per cent on the common stock.

BAY STATE STREET RAILWAY.

The Bay State Street Railway Company reports for the quarter and nine months ending March 31, 1913, compared as follows:

	1913	1912
Gross	$2,027,976	$1,910,085
Net	566,204	548,530
Surplus after charges	116,159	58,838
Nine months' gross	7,028,306	6,775,726
Net	2,478,514	2,320,651
Surplus after charges	1,077,546	893,643

PACIFIC LIGHT & POWER.

The Pacific Light & Power Corporation reports earnings for the two months ended February 28, 1913, as follows:

	1913	1912
Gross revenue	$434,204	$393,822
Net after taxes	185,214	157,486
Other income	19,482	3,893
Bond interest	78,603	87,894
Balance	126,993	73,485

Interest on the $10,000,000 first and refunding five-per-cent bonds issued in connection with the construction of the hydroelectric development at Big Creek is not charged against income in the above statement, this interest being charged to construction account. Earnings of the company, however, are ample to take care of all fixed charges and leave a good margin of safety even were the interest on the first and refunding bonds charged against present income.

AMERICAN GAS & ELECTRIC COMPANY SUBSIDIARIES.

The Atlantic City Electric, Canton Electric, Marion Light & Heating, Muncie Electric Light, Rockford Electric, Scranton Electric and Wheeling Electric Companies, subsidiaries of the American Gas & Electric Company, report earnings as follows for March, 1913, and the twelve months ended March 31, 1913:

ATLANTIC CITY ELECTRIC.

	1913.	1912.
March gross	$ 35,256	$ 30,908
Net	14,505	14,587
Surplus after charges	5,409	5,496
Twelve months' gross	460,057	429,546
Net	262,820	242,363
Surplus after charges	158,757	143,615

CANTON ELECTRIC.

March gross	$ 32,427	$ 30,113
Net	14,996	15,170
Surplus after charges	10,273	10,413
Twelve months' gross	373,486	320,584
Net	175,988	162,375
Surplus after charges	119,352	106,067

MARION LIGHT & HEATING.

March gross	$ 21,340	$ 18,857
Net	9,594	6,183
Surplus after charges	5,816	3,162
Twelve months' gross	233,686	200,385
Net	95,773	91,938
Surplus after charges	54,504	57,337

MUNCIE ELECTRIC LIGHT.

March gross	$ 40,152	$ 33,360
Net	16,497	12,911
Surplus after charges	9,465	6,588
Twelve months' gross	411,751	327,011
Net	175,184	141,767
Surplus after charges	91,752	68,782

ROCKFORD ELECTRIC.

March gross	$ 39,088	$ 36,152
Net	20,336	16,862
Surplus after charges	12,813	9,946
Twelve months' gross	427,766	395,584
Net	214,779	187,841
Surplus after charges	120,505	95,758

SCRANTON ELECTRIC.

March gross	$ 86,706	$ 68,249
Net	57,088	37,194
Surplus after charges	43,037	25,314
Twelve months' gross	830,518	751,969
Net	485,862	424,010
Surplus after charges	329,227	284,369

WHEELING ELECTRIC.

March gross	$ 25,011	$ 20,617
Net	11,543	8,065
Surplus after charges	5,775	1,026
Twelve months' gross	270,999	229,642
Net	124,107	16,893
Surplus after charges	61,439	75,272

NEW ENGLAND TELEPHONE & TELEGRAPH.

The New England Telephone & Telegraph Company issues its annual statement for 1912, which compares as follows:

	1912.	1911.
Gross	$16,324,305	$13,849,394
Operating expenses	6,320,173	5,521,267
Taxes	1,004,346	824,901
Repairs and depreciation	5,531,089	4,372,423
Total expenses	12,855,609	10,718,591
Net	3,468,696	3,130,803
Interest	345,581	135,315
Net income	*3,123,115	2,995,787
Dividends	2,810,858	2,144,521
Surplus	312,256	350,965

*Equal to 7.97 per cent on $39,178,100 capital stock, as compared with 7.64 per cent earned on same stock previous year.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	May 19	May 12
American Tel. & Tel. (New York)	128	127¾
Commonwealth Edison (Chicago)	*132	*132
Edison Electric Illuminating (Boston)	261	260
Electric Storage Battery common (Philadelphia)	47¼	47¾
Electric Storage Battery preferred (Philadelphia)	47¼	47¾
General Electric (New York)	138	137¾
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	1½	1⅝
Massachusetts Electric common (Boston)	16	16
Massachusetts Electric preferred stamped (Boston)	73	73
National Carbon common (Chicago)	116	116
National Carbon preferred (Chicago)	115	115
New England Telephone (Boston)	142	140
Philadelphia Electric (Philadelphia)	22⅝	22¾
Postal Telegraph and Cables common (New York)	81	80
Postal Telegraph and Cables preferred (New York)	66	67
Western Union (New York)	65	61¾
Westinghouse common (New York)	61	61¼
Westinghouse preferred (New York)	105	110

*Last price quoted.

Monthly Earnings Statement.

PORTLAND RAILWAY, LIGHT & POWER COMPANY.

	1913	1912
March gross	$ 544,896	$ 543,138
Net after taxes	268,748	258,088
Surplus after charges	107,750	126,935
12 months' gross	6,677,595	6,424,341
Net after taxes	3,382,019	3,279,366
Surplus after charges	*1,561,135	1,732,725

*Equal to 6.2 per cent on the $25,000,000 common stock.

COMMONWEALTH POWER, RAILWAY & LIGHT COMPANY.

	1913	1912
March gross	$ 562,853	$ 492,601
Net after taxes	244,519	202,162
Surplus after charges	108,283	91,640
12 months' gross	6,603,175	5,685,169
Net after taxes	2,812,321	2,398,406
Surplus after charges	1,288,105	1,092,775

Surplus for common stock after payment of preferred dividends is equal to 7.2 per cent on the common stock.

UNION RAILWAY, GAS & ELECTRIC COMPANY.

	1913	1912
March gross	$ 387,918	$ 315,800
Net after taxes	164,117	127,162
Surplus after charges	64,162	55,919
12 months' gross	4,259,868	3,331,679
Net after taxes	1,807,119	1,409,292
Surplus after charges	755,037	641,335

Surplus after payment of dividend on preferred stock is equal to 7.3 per cent on outstanding common stock.

EAST ST. LOUIS & SUBURBAN COMPANY.

	1913	1912
March gross	$ 215,594	$ 201,018
Net after taxes	95,994	91,117
Surplus after charges	46,281	42,471
12 months' gross	2,503,497	2,322,714
Net after taxes	1,113,879	1,035,747
Surplus after charges	531,854	480,216

Balance, after payment of preferred dividends is equal for the twelve months to 2.6 per cent on the outstanding common stock.

ST. JOSEPH RAILWAY, LIGHT, HEAT & POWER COMPANY.

	1913	1912
March gross	$ 103,807	$ 94,320
Net after taxes	48,157	42,118
Surplus after charges	27,959	22,408
12 months' gross	1,198,143	1,126,004
Net after taxes	520,010	439,036
Surplus after charges	282,562	206,333

Surplus after payment of preferred dividends, is equal to 5.7 per cent on the outstanding common stock.

NEW YORK RAILWAYS.

	1913	1912
March gross	$1,206,307	$1,125,027
Net, after taxes	434,833	323,967
Other income	31,711	30,953
Total income	466,544	354,920
Int. on underlying bonds	225,448	216,610
Income available for interest on Co.'s bonds	241,096	138,310
Interest on refunding 4s.	54,320	55,894
Net income	186,776	82,416
Nine months' gross		$10,480,969
Net, after taxes		3,678,211
Other income		319,458
Total income		3,997,670
Interest on underlying bonds		2,024,034
Income available for interest on Co.'s bonds		1,973,636
Interest on refunding 4s		488,878
Interest on adjustment income 5 per cent bonds		689,107
Net income		795,651
Passengers carried		203,411,532

PERSONAL MENTION.

DAVID DALY, manager of the Houston Electric Company, has been appointed manager of the Galveston-Houston Electric Railway Company.

HARRY FRITH has been appointed commercial manager for the Central Illinois Utilities at Watseka, Ill., succeeding D. D. MAXWELL, resigned.

C. J. SPRAGLE has been appointed general manager of the Public Utilities of Somerset, Ky., which are operated by the Kentucky Utilities Company. He succeeds J. L. WADDLE.

EDWARD N. LAKE, formerly in charge of the electrical division of the Stone & Webster Engineering Corporation, of Boston, Mass., will hereafter represent that company in Chicago.

W. L. VAUGHN of Peoria, has been made superintendent of the Elgin & Belvidere Railway, to succeed Oscar St. John, who has accepted a position with the Illinois Northern Utilities Company.

B. J. DENMAN has been appointed assistant general manager of the United Light & Railways Company, with headquarters at Davenport, Iowa, and will be in direct charge of the electric properties of the company in Iowa.

JOHN S. KENNEDY, who has been the secretary of the New York Public Service Commission for the Second District since it came into existence in 1907, will leave the service of the State on May 15 to go with the New York Telephone Company.

L. C. BRADLEY, who has been in charge of the Stone & Webster street and interurban railway properties at Galveston and Houston for several years, has been appointed assistant district manager for all the properties of the firm in Texas, with headquarters at Dallas. Prior to this appointment the Texas properties have been in charge of District Manager Phinney, with headquarters at Boston.

C. A. HOWE, general manager of the Holophane Company Limited, Toronto, delivered to the staff of the Toronto Electric Light Company on the evening of May 12, a short talk on "Modern Store Lighting" with practical demonstrations. Mr. Howe was assisted by F. T. Groome, chief engineer of the Holophane Company. About 75 members of the Toronto Electric Light Company's staff were present and profited by the very practical manner in which Mr. Howe presented his important subject.

CARL A. KLEMM, manager of the Louisville branch of the Westinghouse Electric & Manufacturing Company, and Statesman of the local branch of the Jovian Order, announces a rejuvenation to be held on the first Wednesday in June, at which it is expected that fully 75 new members will be initiated. An active campaign is now being carried on by the Louisville members of the order for new blood, and indications so far are that it will be successful to the extent indicated. A large number of the novitiates are coming from various points out in the state.

FRANK H. GOLDING, one of the most enterprising and popular men in the central-station industry and for five and a half years manager of the Rockford Electric Company, Rockford, Ill., will leave that city about June 5 to take charge of the electric properties at Jersey City, N. J. Mr. Golding has been one of the most active citizens and has worked for the upbuilding of Rockford in a way that has won him the esteem and confidence of the entire city. He is a director of the Chamber of Commerce, a member of the Rockford Club, and a member of the Rockford Country Club.

OBITUARY.

FRANK O. BRIGGS, first assistant treasurer of John A. Roebling's Sons Company, died in Trenton, N. J., on May 8. Mr. Briggs served a term as United States Senator from New Jersey, and was widely known and highly esteemed.

GEORGE D. ROSENTHAL, manager of the St. Louis office of the General Electric Company, died following an operation at St. Louis on Monday, May 19.

HORACE GREELEY BURT, one of the best known railway men in the United States and formerly president of the Union Pacific Railway, died on May 19. For two years Mr. Burt had been engaged by the Chicago Association of Commerce to study the question of abating the smoke nuisance of Chicago, with particular reference to the question of electrification of steam railroad terminals. Mr. Burt was born in January, 1849. He graduated from the University of Michigan in 1872 and the next year began railway work as a rodman. He held various positions with the Chicago & Northwestern Railroad until 1888, when he became general manager of the Fremont, Elkhorn & Missouri Valley & Sioux City Railway Companies. In 1896 he became general manager of the Chicago, St. Paul, Minneapolis & Omaha Railroad. He was made third vice-president of the Chicago & Northwestern Railroad the following year and from 1898 to 1904 he was president of the Union Pacific Railroad. Before engaging with the Chicago Association of Commerce he was in Asia for a year

STEPHEN DUDLEY FIELD, sometimes called the "father of the trolley car" and known as an inventor of international prominence, died at his home at Stockbridge, Mass., on May 18 at the age of 68 years. Among the inventions patented by Mr. Field are the quadruplex telegraph, the electric elevator, the amplifier for doubling the speed of ocean cables, the stock ticker, the hotel annunciator, and the police patrol telegraph. Altogether Mr. Field had more than 200 patents in his own name. Mr. Field began in 1879 a series of experiments with motors which could be attached to street cars. He was handicapped for a time by the lack of funds, but carried his work to a successful termination and constructed the first electrically propelled car ever built which proved practicable. He used what now is called the third-rail system. The overhead trolley was also of his devising. Mr. Field built his first trolley car at his home in Stockbridge, and it was exhibited there in August, 1880. He sold out his rights to his patents in 1896 to the General Electric and Westinghouse Companies. He made the first application of a quadruplex telegraph to an ocean cable between Key West and Havana in 1909. Few probably knew that Mr. Field equipped the first long-distance telephone line in this country. It ran from French Corral in San Francisco to the summit of the Sierras, a distance of sixty miles, and had twenty-four stations. Many of Mr. Field's inventions are familiar sights, although none of them bear his name. His first electric hotel annunciator was placed in the Palace Hotel, San Francisco, more than 40 years ago. Mr. Field was born at Stockbridge, Mass., on January 31, 1846, the son of Jonathan Edwards and Mary Ann Field. He was a nephew of Cyrus W. Field of Atlantic cable fame, David Dudley Field, the jurist, and of Stephen J. Field, former member of the United States Supreme Court. His early education was obtained in the Williams Academy of Stockbridge. He was first employed in California as an operator for the California State Telegraph Company. Mr. Field was a member of the American Institute of Electrical Engineers and the Institution of Electrical Engineers of London.

DATES AHEAD.

Electrical Supply Jobbers' Association. Spring meeting, Congress Hotel, Chicago, Ill., May 26-28.

National District Heating Association. Fifth annual convention, Indianapolis, Ind., May 27-29.

Society for Electrical Development. Annual meeting, Sherman Hotel, Chicago, Ill., June 2.

National Electric Light Association. Annual convention, Medinah Temple, Chicago, Ill., June 2-5.

American Institute of Electrical Engineers. Annual convention. Cooperstown, N. Y., June 23-26.

Society for the Promotion of Engineering Education. Annual convention, Minneapolis, Minn., June 24-26.

Canadian Electrical Association. Annual convention, Toronto, June 25-27.

Electrical Contractors' Association of the State of Missouri. Annual meeting, St. Louis, Mo., July 12.

National Electrical Contractors' Association. Annual meeting, Chattanooga, Tenn., July 16-19.

Michigan Section, National Electric Light Association. Annual convention, Ottawa Beach, Mich., August 18-21.

With the Electrical Manufacturers

Richmond Electric Works, Richmond, Va., has been awarded a contract for 30 induction motors for the shops of the Texas &New Orleans Railroad at Houston, Tex. The aggregate horsepower represented by these motors is 600.

H. T. Paiste Company, Philadelphia, Pa., in Paistery bulletin No. 86 calls attention to its new 1913 catalog, which is designated as No. 19 and will be ready for distribution about June 1. Included in this catalog will be a number of new sockets, receptacles, plugs, fusettes and pipe taplets. The present bulletin also calls attention to the new Pony P. K. rosettes and a new Paiste weatherproof receptacle.

The Bristol Company, Waterbury, Conn., has issued bulletin No. 169, which describes and illustrates Bristol counters for automatically counting and registering revolutions or strokes. The bulletin also refers to the Bristol mechanical time recorders, electric time recorders, and long-distance recording tachometers. Among the new Bristol counters is a set-back counter, which can be quickly and easily set back to zero position.

Allgemeine Elektricitäts Gesell-Schaft, Berlin, Germany, has issued bulletin No. 6 of its series devoted to applications of electricity to agriculture. This is devoted to electric threshing, pointing out the economy and other advantages of this method of driving and showing several motor-driven threshing outfits in service. These are all mounted on wagons to be readily portable. The motors used range from 7.5 to 50 horsepower.

Federal Sign System (Electric), Chicago, Ill., has established excellent relations with the electric utilities companies in the Bluegrass region of Kentucky, as a result of which a large number of signs have been placed in Louisville, Winchester, Paris, Richmond, Mt. Sterling, Middlesboro and other neighboring cities. In many of these places there were practically no electric signs till the co-operative arrangement was made with the Federal interests. The business is now rapidly increasing throughout this district.

The B. F. Goodrich Company, Akron, O., has issued a 68-page handbook entitled "Motor Trucks of America." This book contains photographs of the more important specifications of the 1913 models of American motor trucks, whose manufacturers furnish the Goodrich wireless motor-truck tires either as standard equipment or supply them without extra charge when specified; 58 manufacturers are represented in this list, among them being a considerable number manufacturing electric motor trucks. This handbook is a valuable one in giving a quite extensive series of data on motor trucks.

National India Rubber Company has moved the western sales office of its insulated wire and cable department from the Peoples' Gas Building to the building at 547 to 551 West Van Buren Street, Chicago. The business of this Chicago branch has grown so rapidly that it has been found necessary to make this move to more commodious and suitable quarters. The new branch is now located very near to the Chicago headquarters of a number of electrical manufacturing companies. Patrick Lyons is the manager of the Chicago branch and to him is due in no small measure the rapid increase of its business.

The Colonial Fan & Motor Company, of Warren, O., has issued its 1913 catalog of electric fans. This includes no less than 60 different types, voltages and sizes of fans, among which are: 8, 12 and 16-inch direct-current and alternating-current desk and bracket fans, 12 and 16-inch oscillating fans for each current, three types of 56-inch direct-current ceiling fans, 12 and 16-inch direct-current and alternating-current ventilating fans, and six sizes of direct-current exhaust fans. The desk and bracket, oscillating and ventilating fans are made for two voltages, 110 and 220; ceiling fans are made for five voltages, 110, 170, 220, 250 and 500; the exhaust fans are made for 110, 220 and 500 volts. The catalog describes and illustrates each type of fan and gives its speed, current input and other data.

General Electric Company, Schenectady, N. Y., has issued a number of new bulletins. Bulletin No. A4071 is devoted to ornamental lamp brackets and center-span-suspension fixtures for series and multiple incandescent street lighting; the variety of these fixtures is evident from the fact that this bulletin covers 27 standard pages. —Bulletin No. A4095 deals with direct-current switchboards with equalizer switches on the panels; these boards are 90 inches high and are arranged for double polarity, 125 and 250 volts.—Bulletin No. 4947A is entitled "Edison Mazda Lamps for Standard Electric Railway Service;" 23-watt and 36-watt lamps are described and their advantages over all other types of incandescent lamps for this service clearly and strikingly pointed out with the aid of numerous comparative views and test results.

Engineering Department, National Electric Lamp Association, Cleveland, O., has issued bulletin 18-A devoted to Mazda street-railway lamps. This bulletin gives a collection of technical data compiled especially for street-railway engineers, but the material is of such character as to be of general interest to all engaged in the lamp industry. The bulletin gives the latest information concerning the lighting of street cars by means of Mazda lamps, pointing out the peculiar adaptability of these units for this service. Cost tables and performance curves are given, together with views of the lamps and of a car illuminated thereby. There is also included a discussion of the candlepower regulation of Mazda street-railway lamps, their life performance, and also some information on the best illumination system for lighting of street cars and car barns.

The Electric Controller & Manufacturing Company, Cleveland, O., has issued a number of new bulletins. Bulletin 1032 describes type H cast grid resistances. The grids are made in current capacities from 20 to 80 amperes, and when assembled in sections current ranges from 20 to 240 can be obtained. Bulletin 1035 is devoted to type B limit stops for direct-current motors. The principal application of these types is to prevent over-travel of the hook block on electric cranes. They are also serviceable for door hoists, soaking-pit covers, tilting furnaces and any motor-driven machine which must be automatically stopped when reaching a given position. A third bulletin is entitled "The Electrical Equipment of Modern Mill Cranes." This is a reprint of an article by H. F. Stratton from the *Iron Trade Review.* This article is devoted particularly to control equipment for these cranes, in which is embodied dynamic braking. A large number of illustrations of typical installations and of parts of the equipment are shown and a series of performance curves.

Record of Electrical Patents.

Issued by the United States Patent Office, May 13, 1913.

1,061,255 Method of Treating Electrometallurgical Products. T. B. Allen and F. J. Tone, assignors to Carborundum Co., Niagara Falls, N. Y. Carbide and silicide impurities are removed from abrasives and refractories by heating with sulphur.

1,061,256. Manufacture of Silicon. T. B. Allen and F. J. Tone, assignors to Carborundum Co. Briquets of a silicious and carbonaceous mixture are heated by an electric arc.

1,061,281. Electric-Motor Truck. C. E. Frede, assignor to Double Body Bolster Co., St. Louis, Mo. Relates to the mechanical construction.

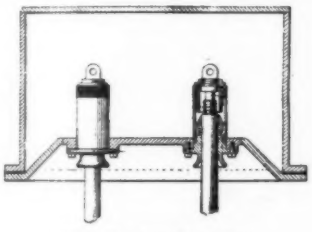
1,061,285. Selective System of Telephony. R. C. M. Hastings, assignor to International Telephone Co., Columbus, O. For selectively calling any party, shunting all other parties on the line.

1,061,286. Selecting Apparatus for Telephone Systems. R. C. M. Hastings, assignor to International Telephone Co. A special selective key for switchboard use.

1,061,287. Telephone System. R. C. M. Hastings, assignor to International Telephone Co. Describes the shunting device referred to in No. 1,061,285.

1,061,289. Electric Heater. C. C. Heyder, Hansford, W. Va. For heating instrument tubes.

1,061,299. Electric-Motor Control. P N. Jones, Pittsburgh, Pa. Describes a special method of changing railway



1,061,527.—Junction Box.

motors from series to parallel working.

1,061,309. Ship's Log. T. H. McQuown, Cambridge, Mass. A trailing actuator with a make-and-break device is towed by and electrically connected through a cable with the indicating mechanism.

1,061,322. Heddle and Heddle-Frame. B. A. Peterson, assignor to Barber-Colman Co., Rockford, Ill. Breaking of the thread causes the heddle to close an electric stop-motion circuit.

1,061,326. Magnetically Operated Tripping Device. M. R. Rodrigues, Brooklyn, N. Y. An electromagnetic latch.

1,061,369. Safety Device to Keep Wheels From Sliding. J. A. Gruber, Cincinnati, O., assignor of one-half to W. H. Hambaugh. Has a special pedal-controlled electric motor for driving a roll of fabric against the front car wheels.

1,061,372. Indicating Torque-Meter. A. E. Guy, Pittsburgh, Pa. A lamp throws its rays into the path of movement of a reflector mounted on the shaft connecting the motor and driven machine.

1,061,375. Electric Welding. J. A. Heany, Washington, D. C. An A. C. generator with heavy flywheel is constantly driven but intermittently energized only during welding periods.

1,061,376. Electrode for Electric Welding-Machines. J. A. Heany. Has a copper core in a steel sheath.

1,061,377. Electric Welding System. J. A. Heany. A D. C. source is connected to the primary of a welding transformer through two automanual switches for alternately making and breaking the circuit.

1,061,378. Electric Welding-Machine. J. A. Heany. Includes an adjustable timing switch for determining duration of the welding current.

1,061,428. X-Ray System. H. F. Waite, New York, N. Y. Has a special rectifier in the primary circuit of the transformer.

1,061,433. Electrical Heating Apparatus. H. M. Wicker, New York, N. Y. A thermostatic electromagnetic regulator is arranged to change connection of the heating units from parallel to series, or the reverse.

1,061,471. Trolley-Controlling Device. A. A. Grossarth and T. E. Barker, Chicago, Ill. A retriever including a spring drum and compressed-air clutch.

1,061,505. Advertising Device. M. H. Shoenberg, assignor to Presto Electrical Manufacturing Co., San Francisco Cal. An "ad"-carrying pendulum, is electrically oscillated and illuminated.

1,061,512. Hammer. Harry B. White, Canton, O. Electromagnetically actuated.

1,061,514. Elevator Alarm. J. C. A. Anderson, Chicago, Ill. An electric alarm indicates when a certain weight has been loaded on.

1,061,515. Telephony. C. A. Bals, Chicago, Ill., assignor to Corwin Telephone Manufacturing Co. Provides means for disconnecting the battery of one exchange when an interexchange trunk is used.

1,061,516. Telephone-Exchange System. C. A. Bals, assignor to Corwin Telephone Manufacturing Co. Relates to details of the operators' and cord circuits.

1,061,519. Controlling Apparatus. W. G. Blauvelt and E. C. Molina, assignors to American Telephone & Telegraph Co. A selector comprising controlling relays arranged in groups.

1,061,527. Junction Box for Electrical Cables. C. W. Davis, assignor to Standard Underground Cable Co., Pittsburgh, Pa. A water-tight iron box with two cable sleeves through the raised bottom.

1,061,529. Alternating-Current Dynamo-Electric Machine. W. Doinikoff, Baden, Switzerland. A commutating-pole rotary converter with an auxiliary armature core.

1,061,541. Primary Battery. E. E. Hudson and D. Elms, assignors to Thomas A. Edison, Inc., West Orange, N. J. The positive plate has a small depression which wears away first and thus indicates need of removal.

1,061,550. Device for Driving Electric Clocks and Similar Apparatus. G. O. Larsson, assignor to Aktiebolaget L. M. Ericsson & Co., Stockholm, Sweden. An electromagnet, in series with which is a condenser, maintains the pendulum in vibration.

1,061,572. Electric Battery. C. F. Schuh, Newark, N. J., assignor of one-half to R. J. Wilkie. Each terminal of a dry cell has a connecting loop of wire secured to it under the top seal.

1,061,577. Rifle Range, Target, and the Like. A. N. Whitney, Melbourne, Victoria, Australia. A remote-controlled motor-driven carriage is arranged to move the target along a track.

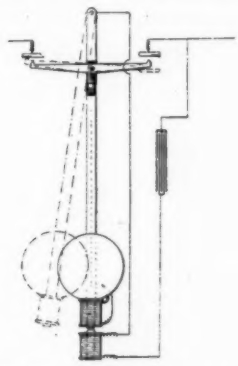
1,061,578. Push-Button Switch. H. Wischhusen and A. Hepke, Berlin, Germany. Covers details of construction.

1,061,583. Apparatus for Repairing Electric Metallic-Filament Lamps. O. Arendt, Berlin, and C. Schlesinger, Strassburg, Germany. Has a special burner for fusing a hole in the bulb.

1,061,589. Busy-Signal Attachment for Telephones. A. M. Beeler, Seattle, Wash. A small lamp on a desk stand is lighted when the called line is busy.

1,061,598. Escaping-Gas Alarm. O. Casilli, Newark, N. J. Includes an electric bell.

1,061,607. Time Recorder and Indicator. H. T. Goss, Rutherford, N. J.



1,061 550.—Electric Pendulum.

and J. W. Bryce, Brooklyn, N. Y. An electromagnetically operated time stamp.

1,061,612. Regulating Electric Furnaces. P. L. T. Heroult, assignor to Societe Electro-Metallurgique Francaise, Froges, France. Includes an interrupter with a rotating ring of segments and a contact brush.

1,061,613. Contact-Breaker for Electrical Ignition in Internal-Combustion Engines. G. Honold, Stuttgart, Germany. Auxiliary to a magneto.

1,061,620. Insulator. H. R. Markel, Columbus, O. A rectangular cleat with a tongue in the cap fitting into the base on either side of which is a wire recess.

1,061,624. Electromotor. C. R. Moore, Lafayette, Ind. Includes a permanent magnet, a swinging armature and an electromagnetic shunt.

1,061,635. Heating System. O. A. Ross, Rochester, N. Y. Includes a thermostatically controlled, electric-motor-driven circulating pump.

1,061,647. Flush Switch. J. J. Wesly, assignor to Metropolitan Electric Manufacturing Co., New York, N. Y. A push-button wall switch.

1,061,650 and 1,061,651. Telephone System. F. G. Agrell, Stockholm, Sweden. Relate to semi-automatic selecting and switching devices.

1,061,666. Magnetic Separator. H. W. Freese, Chicago, Ill. A continuous belt is drawn under rotating magnet wheels with multipolar windings.

1,061,671. Lightning-Arrester. J. D. Hilliard, Jr., and C. E. Parsons, Glens Falls, N. Y. For three-phase circuit; has a horn gap and shunted resistance between each wire and a common neutral point and a horn gap between this and ground.

1,061,717. Arrangement for Producing Electrical Oscillations. Georg Graf von Arco, assignor to Gesellschaft für Drahtlose Telegraphie M. B. H., Berlin, Germany. Describes an interrupter for a quenched-spark wireless system.

1,061,733. Harmonic Electric Bell or Ringer. C. J. Erickson, assignor to First Trust & Savings Bank, Chicago, Ill. For telephone use.

1,061,741. Clock. L. D. Giddens, Wilson, N. C. Includes an electric alarm.

1,061,758. Electrode. C. R. Kruger, assignor to General Electric Co. An arc light electrode containing titanium carbide and a small percentage of metallic copper.

1,061,763. Electric Fire-Alarm. L. J. Loeffler, Stapleton, N. Y. Covers details of the alarm box.

1,061,766. Diaphragm of Telephonic Receivers and Like Instruments. A. Marr, Manchester, England. The diaphragm is clamped by a V-shaped ring engaging the circular edges only.

1,061,786. Device for Synthesizing Gas. W. Siebert, assignor to General Electric Co. Concentric electrodes are arranged to produce a disk-like high-tension discharge.

1,061,802. Life-Detecting Apparatus. P. J. Backus, Delphos, O. The body is placed in an air-tight casket and subjected to partial vaccum, electrically produced heat and electrification, a telephone transmitter at the chest sending out any evidences of life.

1,061,809. Binding-Post. F. E. Bocorselski and C. K. Lassiter, Richmond, Va. Between a flange on the body and a flange sleeve on the head is a coiled compression spring.

1,061,813. Telephony. S. G. Brown, London, England. The variable-resistance cell of a telephone transmitter comprises two hard surfaces of iridium and intervening granules of osmium-iridium alloy.

1,061,823. Tie Wire for High-Voltage Circuits. J. Cronin, assignor to Cronin Electrical Appliances Co., Wapakoneta, O. A two-part tie wire passing around the insulator and wound about the conductor.

1,061,824. Lightning Rod. J. Z. Curnutt and E. E. Lloyd, Maryville, Mo. Includes a multiple-point terminal.

1,061,849. Transmitter. F. Kayser, Philadelphia, Pa. The carbon variable resistance cell is in the base of a desk stand and is connected to the diaphragm by means of carbon rods.

1,061,852. Exchange System for Telephone Lines and the Like. A. Lawrence, Elizabethtown, Ill. Relates to the multiple connection and arrangement of the jacks.

1,061,863. Railway Signal System. W. D. Nickum, assignor to Railway Safety Signal Co., Los Angeles, Cal. An electric block-signal system.

1,061,892. Method and Apparatus for the Production of Long Electric Arcs for the Treatment of Gases. F. H. A. Wielgolaski, Christiania, Norway. The gases are blown from the inner to the outer ends of the electrodes.

1,061,894. Protective Apparatus for Electric Circuits. R. L. Baker, Joplin, Mo. A plunger-type high-tension fuse plug for use on pole lines.

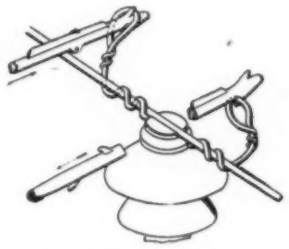
1,061,895. Cable Roller. F. N. Bierce. assignor to Specialty Device Co., Cincinnati, O. Has a two-armed hanger for mounting on the messenger wire and an intermediate clamp for gripping the same.

1,061,898. Telephone Lockout. W. L. Campbell, assignor to First Trust and Savings Bank, Chicago, Ill. Has means for locking the calling dial of all other subscribers on the line to prevent intrusion.

1,061,915. Spark Plug. C. F. Johnston, assignor of one-half each to C. C. Eldridge and E. J. Beebe, Marshalltown, Iowa. Covers construction details.

1,061,919. Magnetic Switch. C. G. Miller, New York, N. Y. A magnet causes an arm to move back and forth.

1,061,921. Ignition Controller for Internal-Combustion Engines. M. Oustad, Hamar, Norway. Excessive engine speed causes the ignition circuit to be broken until normal speed is resumed.



1,061,823.—Tie Wire.

1,061,947. Winding Machine. E. R. Phillips, Phillipsdale, R. I. For winding wire on spools.

1,061,960. Electric Signaling. F. W. Lyle, assignor to General Electric Co. Includes a pair of boron resistances connected between a three-wire circuit and signal-detecting transforming coils.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired May 19, 1913.

560,184. Magnetic Separator. F. J. Barnard, Seattle, Wash.

560,193. Block-Signal System. A. L. Creelman, Chicago, Ill.

560,212. Circuit for Latent-Signal Transmitters. F. B. Herzog, New York, N. Y.

560,216. Electromagnetic Dash-Pot. J. D. Ihlder, Yonkers, N. Y.

560,217. Electric Automatic Stop for Elevators. J. D. Ihlder.

560,255. Hanger for Electric Arc Lamps. T. H. Brady, New Britain, Conn.

560,262. Head Block for Arc Lamps. A. N. Edeburn, Cleveland, O.

560,265. Electric Railway System. J. C. Henry, Westfield, N. J.

560,269. Electric Railway. N. Leidgen, Milwaukee, Wis.

560,271. Registering Dynamometer. G. W. Lewin, Fall River, Mass.

560,272. Connection for Storage Batteries. R. McA. Lloyd, New York, N. Y.

560,275. Switchboard. D. M. Munro, Gaithersburg, Md.

560,284. Electric Igniter for Gas Lighting. W. F. Rudolph, Philadelphia, Pa.

560,291. Electrical Furnace. E. G. Acheson, Monongahela City, Pa.

560,313. Polar Relay. T. B. Dixon, Henderson, Ky.

560,315. Electrically Actuated Dental Plugger. J. W. Gilbert, Philadelphia, Pa.

560,328. Dynamo-Electric Machine. R. Schorch, Darmstadt, Germany.

560,340. Shunt-Circuit Water Rheostat. J. Buchel, New Orleans, La.

560,358. Electrical Annunciator. G. J. King, Oakland, Cal.

560,359. Device for Railway Signaling or Other Purposes. M. B. Leonard, Richmond, Va.

560,360. Electrical Apparatus and System. M. B. Leonard, Richmond, Va.

560,366. Method of Attaching Rail Bonds to Rails of Electric Railroads. D. W. Payne, Elmira, N. Y.

560,370. Electric Igniter for Gas Lighting. W. F. Rudolph, Philadelphia, Pa.

560,375. Power Gearing for Electric Cars. E. A. Sperry, Cleveland, O.

560,379. Electric Measuring Instrument. E. Thomson, Swampscott, Mass.

560,387. Electric Arc Lamp. E. J. Bagnall, Cleveland, O.

560,403. Telephone Receiver. S. D. Field, Stockbridge, Mass.

560,421. Electric Arc Lamp. J. McLaughlin, Chicago, Ill.

560,423. Coin-Controlled Electrical Apparatus. J. N. Pierce, Boston, Mass.

560,427. Circuit-Breaker. W. B. Potter, Schenectady, N. Y.

560,428. Electric Brake. W. B. Potter.

560,451. Electric Block-Signal and Train-Lighting System. J. C. West, Atlanta, Ga.

560,452. Electric Railway System. G. Westinghouse, Jr., Pittsburgh, Pa.

560,455. Rail Bond for Electric Railways. H. W. Wyman and F. H. Daniels, Worcester, Mass.

560,471. Electric-Railway Switch and Box Therefor. W. Chapman, Washington, D. C.

560,472. Current-Collecting Device for Electric Railways. W. Chapman, and P. W. Davies, Washington, D. C.

560,473. Electric Railway. W. Chapman.

560,476. Electric Arc Lamp. C. L. Coffin, Detroit, Mich.

560,503. Safety Device for Electric Motors. J. D. Ihlder, Yonkers, N. Y.

560,506. Electric Bell. F. Jeil and H. F. Keil, New York, N. Y.

560,513. Electric Railway. R. Lundell, Brooklyn, N. Y.

560,551. Electric Railway System. D. MacL. Therrell, Charleston, S. C.

560,569. Electric Motor Fan. J. D. Brinser, Lancaster, Pa.

560,588. Electric Rheostat or Heater. H. W. Leonard, East Orange, N. J.

560,591. Alternating Electric Motor. R. Lundell, Brooklyn, N. Y.

560,617. Telephone Signal and Signaling Circuit. A. DeKhotinsky, Boston, Mass.

560,619. Electric Signaling Apparatus and System. M. B. Leonard, Richmond, Va.